ORGANIZATIONAL EFFECTS OF SOFTWARE AS A SERVICE:

THE NERDS RISE TO POWER

ABSTRACT

Organizational subunits such as marketing, sales, human resources, and customer service invest in software as a service (SaaS) as a means to reduce information technology costs, speed time to market, gain access to new technologies, and improve application support and maintenance. For these reasons, SaaS has been characterized as a form of outsourcing, and one in which the internal IT function is losing relevancy because contracts are being executed between external application service providers and the affected subunits directly without IT oversight. Here we argue that SaaS is not outsourcing as it has been traditionally envisioned and enacted, and that through the generation of four types of functional slack it has demonstrated the ability to result in higher levels of IT innovation in support of a digital business strategy. This research has established a number of firsts: 1) explored the production and combination of multidimensional slack, concentrated at a functional level; 2) demonstrated a previously disconfirmed positive relationship between IT outsourcing and innovation; 3) confirmed the feasibility of a theorized positive relationship between outsourcing and ambidexterity, and 4) discovered a new pathway within the realm of digital business strategy between a key external trend and an internal organizational shift of roles, responsibilities, and knowledge patterns. Further, our findings suggest that IT ambidexterity may be a better construct for investigating the impact of IT on firm performance and competitive advantage than traditional measures of IT performance.

Keywords: cloud computing, digital business strategy, software as a service, slack, ambidexterity, information technology

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INTRODUCTION

The subordination of information technology (IT) strategy to business strategy has persisted in academic studies for more than two decades. Research seeking hierarchical alignment between IT and business strategies has focused on a variety of vectors, including executive relationships and knowledge sharing, outsourcing, intra- and inter-organizational systems, the business value of IT, and business process effectiveness and efficiency contributing to firm performance (e.g., Flynn et al. 2010; Kearns and Lederer 2003; Lacity and Willcocks 1998; Melville et al. 2004b; Mithas et al. 2011). In each case, and in concert with the Porterian view of the value chain (Porter and Millar 1985), it has been suggested that IT supports the organization in a role of subservience rather than equivalence.

In recent years, however, dramatic improvements in the price and performance of communications, storage, processing power, and portability have impacted the relationship between IT and the organization. Because of digital embeddedness into products and services (El Sawy 2003), IT appears to be joining the value chain proper, thus merging IT and business strategies into a uniform digital business strategy. Digital business strategy has been defined as an "organizational strategy formulated and executed by leveraging digital resources to create differential value" (Bharadwaj et al. 2013). Digital business strategy contains endogenous and exogenous components, with internal characteristics comprised of 'soft' organizational shifts in business models, managerial roles, and knowledge. External aspects are considered as 'hard' technological trends in infrastructure, including pervasive connectivity, information abundance, global supply chains, improved price/performance of IT, the emergence of big data, and the growth of cloud computing (Bharadwaj et al. 2013). This research will focus on a variant of cloud computing, software as a service (SaaS), and how it may be supporting organizational shifts in managerial roles and knowledge as businesses adopt digital strategies, thus permeating the membrane between exogenous technologies and the endogenous organization.

While the economic justification for Infrastructure as a Service (IaaS) and Platform as a Service (PaaS) is dependent on structural contingencies such as application development resources, organizational cost of money, and real property and utility costs, the fiscal argument for SaaS is much clearer and well defined against the existing options of custom application development and packaged software (Garrison et al. 2012). Enacting SaaS is the externalization of business process infrastructure, and because of the distributed nature of SOA architecture with more optimal economies of scale reuse (Candan et al. 2011), it is reported to lower IT costs, speed time to market, provide access to technology, offer improved management of applications, and increase revenue growth rate among other anticipated outcomes (Garrison et al. 2012; Susarla et al. 2009). These lower expenses come in the form of hardware elimination, physical space reuse, and human resource reductions in applications maintenance, testing, and integration, server maintenance, systems administration, and technical support (Benlian and Hess 2011). On top of these cost reductions, SaaS converts capital expenditures in depreciable assets on the balance sheet to operational expenditures on the income statement, which may benefit the financial structure of the organization (Golden 2009).

Many researchers consider SaaS to be a form of outsourcing (Armbrust et al. 2010; Candan et al. 2011; Susarla et al. 2009), but we contend that it is something very different, an approach with profound implications for altering the role of IT within the organizational structure of those firms facing moderate to turbulent environmental uncertainty. Rather than diminish the relevancy of IT, we believe that SaaS will enhance its importance and elevate its position from a support function to a value chain innovator through the creation and allocation of organizational slack. This slack production is the result of cost savings, access to external IT talent for process-oriented applications development, maintenance and support, reduced infrastructure, and perhaps most importantly a redirection of managerial focus from a business process orientation to innovation leading toward differential value through the leveraging of digital resources. Each of these outcomes may be viewed through the lens of organizational slack, whether it is monetary, human resources, operational, or managerial time respectively.

Additionally, the presence of slack in its various forms may provide sufficient resource endowment to enable a shift of the information technology function toward greater concurrent ambidexterity, or a balance between exploitative and exploratory activities (March 1991; Raisch and Birkinshaw 2008) that satisfies current customer needs (exploitation) without sacrificing innovation for future markets and customers (exploration). Resource endowment adequate for the pursuit of simultaneous ambidexterity has traditionally been the province of large firms (cf. Venkatraman et al. 2007), but the adoption of software as a service may create a suitable buffer to allow a greater scope in firm size with regard to the implementation of simultaneous ambidexterity. As with innovation, simultaneous ambidexterity has demonstrated a positive relationship with higher levels of firm performance along a number of dimensions (O'Reilly and Tushman 2013a).

This work will present prior research into organizational slack and ambidexterity, examine the technological and process implications of software as a service, and predict the outcomes that may emerge at their intersection. From this paper, we seek to answer the following research questions:

1) Will the adoption of SaaS result in the creation of multidimensional forms of slack?

2) If so, will that slack be concentrated within IT and serve to restructure the IT function within the firm toward greater levels of innovation and/or ambidexterity?

3) Will this restructuring of IT translate into higher performance at the functional and business unit levels?

LITERATURE REVIEW

Software as a Service

Software as a service (SaaS), a variant of cloud computing, is the internet-enabled form of Application Service Provider (ASP) delivered software on demand. For many decades, application service providers have offered software on mainframe computers in multi-tenant data centers for customers to access remotely (Farber 2008). What makes SaaS different is elastic technology in the form of service oriented architectures (SOA) and web services design language (WSDL) that conform to instantaneous demand, the access method of using a standard browser whether desktop or mobile, and the lower cost of operating a data center using virtualized servers in a locale of inexpensive electric utilities and real estate, and co-located with fiber optic trunk line facilities. All of these SaaS elements combine to rewrite the economics of provisioning and using software on demand.

Software as a service has been likened as a form of outsourcing (Armbrust et al. 2010; Candan et al. 2011; Susarla et al. 2009; Vagadia 2012), and while outsourcing portends to offer expense reduction, capital availability, better cash flow management, and access to specialists, it has not demonstrated a positive relationship with IT innovation (Kakabadse and Kakabadse 2005). The implication is that SaaS will not positively impact IT innovation, and we refute that notion on the grounds that SaaS is not outsourcing in the typical sense because of its ability to generate multiple forms of slack while increasing inbound knowledge flows.

Organizational and Functional Slack

Organizational slack has received numerous definitions (Child 1972; Cohen et al. 1972; Dimick and Murray 1978; Litschert and Bonham 1978; March 1979; March and Olsen 1976), but because James March and his work dominate meanings of organizational slack, Bourgeois condensed and paraphrased what will be considered to be the exemplar characterization: "Organizational slack is that cushion of actual or potential resources which allows an organization to adapt successfully to internal pressures for adjustment or to external pressures for change in policy, as well as to initiate changes in strategy with respect to the external environment" (Bourgeois 1981).

Taking slack from a phenomenological concept to a theoretical framework, Lewin and Wolf (1973)) proposed a number of assertions. Of these, five are relevant to the role of SaaS-generated slack and its disposition, including 1) organizational slack depends on the ability of excess resources, 2) excess resources occur when an organization generates or has the potential to generate resources in excess of what is required to maintain the coalition, 3) the disposition of slack resources is a function of a manager's expense preference function, 4) slack can be present in distributed or concentrated form, and 5) beyond the short term, the reallocation of slack requires a change in organizational goals.

A practitioner survey indicated that 88% of IT executives expected the same or increased budgets for 2014 over 2013 in spite of growing SaaS adoption (Hayman 2013), and because the primary reason given for SaaS adoption is cost savings, we propose the following hypothesis:

H1a: The adoption of SaaS will be positively related to the creation of financial (monetary) slack within IT.

Consistent with the proposition that excess capacity is a form of slack (Bourgeois 1981), the adoption of software as a service should induce excess infrastructure capacity, or operational, slack, for those firms that externalize a software application previously hosted internally, also known as a replacement scenario. This supposition is strengthened by investor research that indicates hardware and software sales growth strongly moving to cloud computing services vendors instead of individual organizations (Reitzes et al. 2012). As such, we make the following hypothesis:

H1b: The adoption of SaaS will be positively related to the creation of operational slack within IT.

Excess capacity may appear as low-discretion operational slack or in the form of personnel whose roles may be repurposed toward supporting the digital business strategy. For those firms that externalize a software application previously hosted internally, there should emerge roles and tasks related to maintenance, support, and upgrades that would be available for redefinition as human resources slack. A practitioner survey indicated that while 47% of IT executives expected to increase hiring in 2014, 66% stated confidence in their ability to satisfy business demands across the organization including a responsibility to increase growth and profitability (Hayman 2013). This data, in conjunction with the escalation of SaaS adoption, indicates a transformation of IT human resources from maintenance and support to innovative activities. Anticipating these transformed resources, we propose the following:

H1c: The adoption of SaaS will be positively related to the creation of human resources slack within IT.

Slack may not always be manifested in a tangible form, such as monetary, operational, or human resources. An important form of nontangible slack is managerial time discretion, or the effort that managers must devote to particular aspects of the business (Bowen 2002). Again, for those firms that externalize a software application previously hosted internally, we believe that IT managers will have additional time with which to direct their efforts toward digital business strategy, thus prompting the following hypothesis:

H1d: The adoption of SaaS will be positively related to the creation of managerial time slack within IT.

Slack and Innovation

Proponents of agency theory view slack as a manifestation of managerial corruption (Fama and Jensen 1983), thus incapable of advancing organizational goals whereas organizational theorists (structural contingency and behavioral) envision slack as an uncertainty buffer that can also fulfill the role of innovative behavior accommodation through funding experimentation (Bourgeois 1981; Cyert and March 1992; Hambrick and Snow 1977). Nohria and Gulati (1996)) responded to this paradox with empirical research designed to uncover a slack-innovation relationship, if any. These researchers found supporting evidence that slack is beneficial toward motivating and funding innovation, but on an inverted U-shaped curvilinear relationship. Too little slack does not provide the necessary impetus to answer the environmental demands for innovation and too much slack has a deleterious effect on investment discipline. The functional level production of slack and its subsequent redirection toward innovative actions was further confirmed by Nohria and Gulati (1996)).

Prior research has demonstrated the positive relationship between slack and innovation, and digital business strategy theory together with practitioner surveys (e.g., Lundquist 2012;

Murphy 2012) indicate an increasingly positive relationship between IT and business-level innovation. For these reasons, we propose the following hypotheses:

H2a-d: The four forms of slack created by SaaS adoption will be concentrated and redeployed from within the IT function.

H3: SaaS-induced slack will positively mediate the transformation of IT toward a greater emphasis on innovative activities.

Organizational and Functional Ambidexterity

An increase in IT-focused innovation may also be perceived as an ambidextrous transformation of the IT function within the business unit. Ambidexterity, or the simultaneous pursuit of exploitative and exploratory learning activities such that current business is executed with routinized process efficiency and future business is pursued with innovative, risk-taking endeavors (Tushman and O'Reilly III 1996), was conceptualized as a continuum of antipodal interests (March 1991). These two managerial schema impose conflicting demands on the organization, in part because exploitative activities seek low variance while exploratory investigations are typified by high variance.

In a supportive role to business strategy, the IT function has traditionally been viewed as pursuing exploitative improvements in business processes (e.g., Melville et al. 2004b; Mithas et al. 2011). However, with digital business strategy and the need for the organization to leverage digital resources, the IT function is at the heart of both exploitative and exploratory activities. This increased focus on ambidextrous activities can potentially result in internal tensions, and if left unaddressed, these internal strains may ultimately result in reduced performance both at the functional and business unit levels. However, we present the notion that software as a service offers a mechanism for imposing structural separation in the form of third-party exploitative expertise. In a similar fashion, Weigelt and Sarkar (2012)) recognized that IT outsourcing may present a means to leverage current needs and future possibilities, but they offer the caveat that outsourcing also represents an abrogation of internal knowledge that limits its performance potential, an outcome not enjoined by SaaS adoption.

We offer the view that unlike traditional outsourcing, SaaS results in increased internal knowledge because of the inflow of exploitative information from the SaaS vendor, which is gaining multi-industry expertise in a particular set of business processes and disseminating it throughout its customer base in the form of continuous, incremental improvement. In this scenario, the pursuit of exploitative activities from within the business unit becomes that of relationship management, a set of tasks offering less tension than the management and dispersion of limited resources to internally competing interests. Sufficient adoption of software as a service within the business unit diminishes the need for these managerial processes and context-dependent "coherence among all the patterns of activities in the business unit" (Gibson and Birkinshaw 2004), thus freeing the IT function to pursue exploratory innovation without the bipolar dilemma of internally-focused ambidexterity. To that end, we propose the following:

H4: SaaS-induced slack will positively mediate the transformation of the IT function toward greater ambidexterity.

Slack and Performance

Because of ambiguity in the slack-performance relationship across a large number of studies, Daniel et al. (2004)) undertook a meta-analysis to determine why results have been inconclusive and further, to ascertain if there is a positive relationship between slack and firm performance and under what conditions it may exist. Extracting 80 samples from 66 studies, the authors offered evidence of a significantly positive slack-firm performance relationship among all three types of slack (available, recoverable, and potential). This relationship was stronger when controlling for industry, which by its nature includes controls of the external environment. While not a direct confirmation of Sharfman et al. (1988)), this emboldens the notion that the slack-firm performance link is subject to a moderating influence of environmental dynamism.

Firm performance specific to IT management has been operationalized as simply business process improvement, regardless of whether efficiency or innovation is the goal (Melville et al. 2004a). Building on that idea is the notion that IT resources influence firm performance through improvements in customer management, performance management, and process management capabilities (Mithas et al. 2011). However, Nohria and Gulati (1996)) have demonstrated that slack may be produced and consumed at the departmental level in the form of innovation, and because of the known pathway between innovation and performance (Leeuwen 2001) together with the role of IT within a digital business strategy, we propose the following hypotheses:

H5: SaaS-induced slack will positively mediate IT performance.

H6: SaaS-induced slack will positively mediate business unit performance.

Slack and Environmental Dynamism

Because slack buffers the organization from environmental turbulence (Cyert and March 1992; Pfeffer and Salancik 1978; Thompson 2003), Palmer and Wiseman (1999)) explored that relationship and they showed that environmental complexity and uncertainty affect managerially perceived risk, which is the driving factor in determining slack requirements. Applying these findings to available and recoverable slack, it may be surmised that in dynamic environments high levels of available slack would mitigate risks due to the availability of immediate liquidity whereas in stable environments high levels of recoverable slack would allow greater production and consequently higher levels of performance. Under these scenarios, industry is not so much a moderating factor than a constraint in how firms choose to compete (Latham and Braun 2008). Building on this confirmed relationship, we propose that:

H7a-d: The amount of slack in each of its four forms created by the adoption of SaaS will be positively moderated by environmental dynamism.

High levels of environmental dynamism in the form of competitiveness has been shown to directly influence the presence of organizational ambidexterity (Auh and Menguc 2005; Jansen et al. 2006). Extending the discussion into IT asset portfolios, Xue et al. (2012)) confirmed the moderating effect of environmental dynamism on actions directed toward efficiency or innovation. Extending this prior research, we proposed the following:

H8: The equilibrium between SaaS-induced IT exploratory innovation and exploitative efficiency activities will be moderated by environmental dynamism.

See Figure 1 for the proposed research model that incorporates the aforementioned constructs and hypothetical relationships.

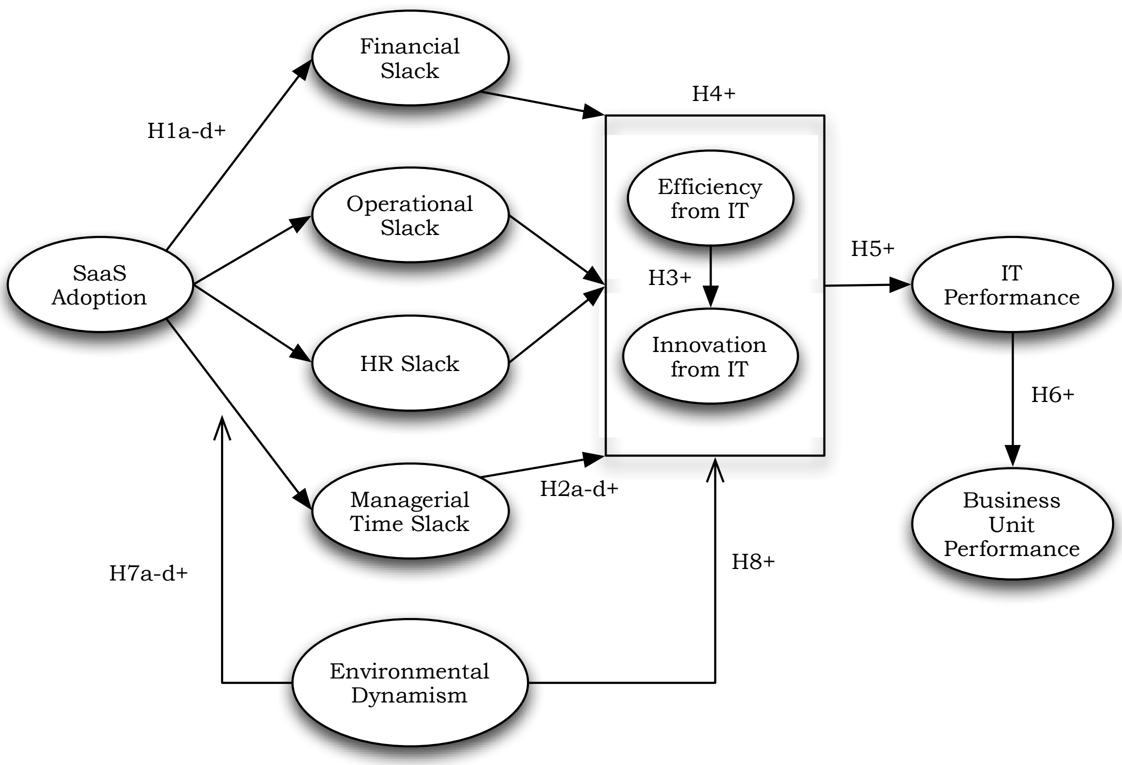

Figure 1. Proposed Research Model

RESEARCH METHODOLOGY

Research Method Introduction

Because very little research has been conducted into the organizational impact of software as a service (SaaS), this work consists of an exploratory case study analysis represented by qualitative and quantitative mixed methods respectively (Jick 1979; Kaplan and Duchon 1988). After a theoretically-grounded instrument development stage, instrument refinement and theoretical feasibility was conducted through case method analysis combining semi-structured and structured measures under the rubric of content analysis.

The preliminary focus was on explanatory issues, such as examining the forces generated by the implementation of SaaS and studying the causal network as proposed in the research model. We sought to uncover the beliefs, attitudes, and policies that shape the adoption of SaaS and any resultant phenomenon that affected the organization and its structure, strategy, performance, and competitive advantage.

Developing an understanding of SaaS adoption, slack production, exploratory activity volume, and ambidexterity necessitated perceptions from the most senior managers within the IT function, those who have insights into both process efficiency and innovation activities and outcomes. In addition, senior IT executives have demonstrated adequate knowledge about the firm's product-market environment in prior research to substantiate the test use of their perceptions of environmental dynamism (Choe 2003; Newkirk and Lederer 2006). Data for the case studies was collected in two forms: 1) using a scale-less, semi-structured interview protocol for SaaS adoption, slack production sources and sinks, and slack consumption or annihilation, and 2) structured, Likert-scaled questions designed to indicate IT functional ambidexterity, IT functional performance, and overall firm performance.

Data Sources

Sample Population

Case study candidates were identified through criteria that included a range of organizational sizes, industry sectors, environmental volatilities, and SaaS adoption scenarios. They were located in the West, Midwest, and South U.S. locations to facilitate the face-to-face interview data collection phase, and two were not-for-profit institutions of higher learning to gauge any dissimilaries between for-profit and non-profit entities.

Environmental dynamism was hypothesized as an important moderator, one that potentially affects both the production of slack (Cheng and Kesner 1997) and its conversion to organizational ambidexterity (Raisch and Birkinshaw 2008), therefore the sample population reflected a range of environmental characteristics. Sørensen (2002)) examined industry volatility using the Capital Asset Pricing Model and its notion of unlevered beta adjusted for cash as a partial proxy for environmental characteristics. This methodology satisfied the initial identification of environmental dynamism, which was subsequently refined through scaled measures.

Instrument Development

Demographic variables describing the industry sector, the role of the respondent, and the respondent’s tenure in that role and the industry were gathered using measures specified by numerous researchers (eg., Carpenter et al. 2004; Feeny et al. 1992). Additionally, measures examining aspects of digital business strategy were employed, including an importance rating of the five key external trends identified by Bharadwaj et al. (2013)), the number of years elapsed since implementing each of the five key external drivers, and the perception of whether various dimensions of slack (hardware, software, and/or personnel costs) were created as a result of the adoption of one or more key external trends.

Software as a Service Variables

The adoption of software as a service should be measured both for depth of penetration into the business operations and longevity. Semi-structured interview items exploring various vectors that describe SaaS adoption were developed and adapted from prior research. Following a similar path as established by Ang and Straub (1998)) for the perceptual measurement of the degree of information systems outsourcing, this study investigated the degree of SaaS adoption by examining spending, business processes, and personnel to determine the breadth and depth of SaaS adoption in addition to longevity to gain a more complete picture of the software as a service phenomenon.

Functional Slack Variables

The measurement of concentrated slack (Lewin and Wolf 1973) required an identification of the resource(s) generating excess capacity, the types of excess capacity created, and the real or potential redistribution of that excess capacity because slack is a phenomena of finite lifespan. Financial slack, or excess money that is created through SaaS adoption, was probed by examining the cost-reduction motivations behind SaaS adoption, the extant presence of financial slack within IT, the impact of that adoption on IT budgets, and the relationship of those budgets to digital business strategy. In a similar fashion, operational, human resources, and managerial time slack was studied as to their appearance due to SaaS adoption, and their respective relationships with implementing a digital business strategy. Measures specified or adapted from Bourgeois (1981)), Damanpour (1991)), and Nohria and Gulati (1996)) were utilized.

IT Innovation and Ambidexterity Variables

Adapting and extending prior work by and Benner and Tushman (2003)) and He and Wong (2004)), Lubatkin et al. (2006)) developed a 12-item measure that recognizes exploitation and exploration dimensions by determining an innovation's proximity to either the current technological trajectory of the firm or to the requirements of existing customers and markets. Using these 12 items as a guide, we stepped the hierarchical level of analysis from that of the firm to that of the IT function through a simple textual substitution of "IT department" in place of "firm."

IT Performance Variables

Perceptions about the performance of the IT department within the business unit was gathered through the use of five items designed to study efficiency and effectiveness outcomes (Powell and Dent-Micallef 1997) along with an indicator of overall IT performance as judged against competitors. This is consistent with dimensions for IT-strategy alignment (Aral and Weill 2007; Porter 1980; Xue et al. 2012) and for competitive advantage measures that seek to identify those firms with above-average performance (Schoemaker 1990).

Business Unit Performance Variables

Business unit performance specific to IT management has been operationalized as simply business process improvement, regardless of whether efficiency or innovation is the goal (Melville et al. 2004a). Building on that idea is the notion that IT resources influence firm performance through improvements in customer management, performance management, and process management capabilities (Mithas et al. 2011). Little research has been conducted into the relationship between IT-focused innovation and firm performance (e.g., Aral and Weill 2007), and as such we will confine this measurement to IT executive perceptions of business unit financial performance relative to chief competitors using interview instruments based on prior measures implemented and validated by Flynn et al. (2010)).

Environmental Dynamism Variables

Perceptual information delineating the environment by market turbulence, competitive intensity, and technological turbulence was provided through the survey instrument devised by Jaworski and Kohli (1993)). Rather than rely solely on a single key informant's perceptions for understanding environmental dynamism, a second questionnaire was delivered to a senior marketing, sales, or business development executive within each case study firm to triangulate subjective data (Jick 1979). When combined with estimated or computed unlevered beta adjusted for cash figures, a total of two subjective and one objective measure for understanding environmental volatility were established and cross-checked.

Covariates

Because this study sought to incorporate relative position and performance within an industry as compared with direct competitors, industry level controls are superfluous. Business unit-level covariates, however, are critical to discerning this research's causality chain against rival plausible explanations such as differences in research and development, brand building through advertising expenses, and age of the firm.

Theoretical and empirical justification linking research and development investment (e.g., Megna and Mueller 1991), advertising investment (e.g., Schmalensee 1978), market share (e.g., Smirlock et al. 1984), and firm size (e.g., Hansen and Wernerfelt 1989) to firm performance has been confirmed and the literature condensed with regard to IT effects on firm performance by Bharadwaj et al. (1999)). An additional covariate, business unit longevity, was included because of the interaction between age and performance through mechanisms such as learning orientation (Calantone et al. 2002), alliance or ecosystem development (Stuart 2000), or governance changes (Anderson and Reeb 2003).

Face Validity

An expert panel consisting of two academics and five senior-level IT practitioners were consulted to refine and confirm the face validity of the measures describing the latent constructs of the research model.

Theoretical Testing and Refinement through Case Method Analysis

While not as prevalent as empirical research, the use of case studies to examine ontological and epistemological conventions in IS research is well supported (e.g., Markus 1983; Olsson et al. 2008; Pawlowski and Robey 2004; Pyburn 1983; Strong and Volkoff 2010). In terms of the phases of knowledge accrual, both exploration and hypotheses testing are in focus.

The survey questions that make up the semi-structured interview guide give support to hypotheses testing (Eisenhardt 1989b) while sufficient flexibility will be ingrained into the interview process to allow the discovery of off-quadrant indications that may alter the research model (Jick 1979). The use of a guide to aid in performing semi-structured interviews has been adopted by a number of IS researchers (e.g., Sherif and Menon 2004; Shim et al. 2002), and this study will continue that tradition.

DATA ANALYSIS

Case Study Demographics

Data from seven cases was collected for this research. Two cases, Alloy and Boson, represent the information technology industry with varying levels of organizational size, environmental dynamism, and revenue growth rates. The consumer goods industry was indicated by two cases, Covalent and Dyne, each with different levels of organizational size, environmental dynamism, and revenue growth rates. Case Electron was a regional health network operating within the medical services industry, unique in this dataset for their competitive landscape and their digital business strategy, which includes a complete absence of SaaS usage. The nonprofit, subsidized higher education market was captured through two cases, Fusion and Gluon, each with varying levels of institutional size, mission focus, and operating structure. Refer to Table 1 for case-level demographic details.

Table 1: Case-level demographic details

Case	Industry	Markets	Approx. Revenue	Approx. Number of Employees	Key Informant	Revenue Growth YoY
Alloy	Computer Systems Design Services	Global	$5B	3,000	CIO	20-25%[1]
Boson	Business Software and Support Services	Global	$700M	3,500	CIO	2-5%[2]
Covalent	Consumer Goods: Food & Beverage	Global	$30B	100,000	CIO	<0%[2]
Dyne	Consumer Goods: Household Furnishings	Global	$3B	7,000	CIO	5-10%[2]
Electron	Medical Services	Regional	$50M	500	CIO	Not reported
Fusion	Higher Education – Public Research	National	$800M[3]	3,500 + 18,000 fulltime students	CIO	<0%[2]
Gluon	Higher Education – Public Vocational	Regional	$30M[4]	700 + 7,000 fulltime students	CIO	100%[5]

[1] As reported by key informant
[2] Computed from archival data
[3] Operating revenues + state appropriations
[4] State, federal, and local revenue sources
[5] as the result of state-mandated inorganic consolidation

Face-to-face interviews lasting approximately one hour were conducted with each key informant in their principle place of business. All key informants held the position of chief information officer (CIO), and each had at least 10 years of experience in either their role as a CIO, their information technology work in the specific industry, or both. Three had attained InformationWeek 500 status in 2013, and all shared pervasive connectivity as a component in their digital business strategy. Six of the seven CIOs also pursued at least one variant of cloud computing, SaaS, as an additional focus of their digital business strategy.

Triangulation

Measures for the four aspects of firm performance in a competitive situation (revenue, revenue growth, market share, and market share growth), three vectors of environmental dynamism (turbulence, competitive intensity, and technological intensity), and control variables in a competitive landscape (capital investment, research and development investment, advertising expenditures, and primary product market share) were gathered from each key informant during the face-to-face interview phase. These 23 Likert-scaled items were also delivered to an executive from the same organization representing marketing, sales, or business development. Incomplete data consisting of seven missing items was received from Case Covalent, and those seven items were removed from the IT survey prior to analysis so as to create a 16-item matched pair. Matching samples from Electron and Gluon were not received.

The two datasets, one from IT and one from Marketing, were processed using the Wilcoxon matched-pairs test within IBM's SPSS Version 22 statistical software program. In all but one case, there was a failure to reject the null hypothesis. The highest two-tailed asymptotic significance was computed as 0.854 for Case Alloy, and the lowest was calculated to be 0.015 for Case Dyne. Reducing the 23 items for Case Dyne to just those eight concerned with firm performance and control variable spending, complete agreement is achieved on four items and a single point on a seven-point Likert scale separates four items. Because of inherent misunderstandings of scale point definitions between individuals and the ‘lumpiness’ of the resultant data (Gardner and Martin 2007), this research has concluded that these two informants hold essentially the same view of external performance and internal expenditures as measured against the industrial/organization environment. However, these results also indicate that the key informant for Dyne is responding to a different set of environmental cues than the marketing function in that organization. Because this study is designed to investigate decisions made by IT and the effects of those decisions on IT and the larger firm, the IT perceptions will be used for further processing and examination (cf. Bourgeois 1985). Refer to Table 2 for more information about the IT and Marketing Wilcoxon matched-pairs results.

Table 2: IT and Marketing Wilcoxon Matched-Pairs Results

Case	Negative Ranks	Positive Ranks	Ties	Total	Z Score	Asymp. Sig. (2-tailed)
Alloy	6	5	12	23	-0.184	0.854
Boson	8	9	6	23	-0.221	0.825
Covalent[6]	4	3	9	16	-1.127	0.260
Dyne	3	11	9	23	-2.433	0.015
Fusion	5	10	8	23	-0.953	0.341

Intercoder Reliability

The process of establishing intercoder reliability for the interpretation and coding of the semi-structured portions of the interviews was followed according to the guidelines set by Lombard et al. (2002).

[6] computed with seven missing items removed as provided by the marketing informant

A coding rubric was developed so that variable-level items could be assessed according to a ranking system where Low = 1, Moderate = 2, and High = 3. Three coders, a full professor, a Ph.D. candidate, and the author, were trained for approximately one hour in the use of the rubric and its application to interpreting and coding responses according to a general understanding of management information systems and specifically the draft research model. The coding process was enacted variable-wise across the six complete cases with coders making independent judgments of the transcribed responses.

Intercoder reliability was checked using Krippendorf's alpha. All measurements were conducted with 10,000 bootstrap samples, and the minimum threshold for instituting acceptable agreement among coders for non-exploratory research is set by an alpha value ≥ 0.80 and perfect agreement is defined by an alpha value ≥ 0.90 (Krippendorff 2012). While there were no disagreements between coders for numerical or binomial items, ranked levels were resolved by averaging coder interpretations such that intermediate rankings were recognized from 1.0 to 3.0 in half-point increments. The variables that were tested for reliability include SaaS adoption level, and the amounts of financial, operational, human resource, and managerial time slack. All variables were in excess of 0.80, with SaaS adoption, financial slack, and human resource slack greater than 0.90. All cases were in excess of 0.90 with the exception of Case Boson, which was measured as greater than 0.85. Refer to Tables 3 and 4 for Krippendorf's Alpha by variable and by case, respectively.

Table 3: Krippendorf's Alpha results by variable

Variable	Pairs Ordinal	Alpha	LL 95% CI	UL 95% CI	Units	Observers
SaaSAdopt	273	0.9527	0.9286	0.9744	91	3
FinSlack	168	0.9074	0.8699	0.9418	56	3
OPSlack	84	0.8932	0.8165	0.9603	28	3
HRSlack	147	0.9293	0.8868	0.9646	49	3
TimeSlack	168	0.8593	0.8006	0.9093	56	3

Table 4: Krippendorf's Alpha results by case

Case	Pairs Ordinal	Alpha	LL 95% CI	UL 95% CI	Units	Observers
Alloy	120	0.9235	0.8852	0.9568	40	3
Boson	120	0.8622	0.7799	0.9311	40	3
Covalent	120	0.9669	0.9448	0.9856	40	3
Dyne	120	0.9127	0.8647	0.9553	40	3
Electron	120	0.9057	0.8158	0.9738	40	3
Fusion	120	0.9271	0.8879	0.9612	40	3
Gluon	120	0.9149	0.8702	0.9553	40	3

Individual Case Analyses

Using interpreted and coded responses from the interview data, each case was evaluated with respect to the qualitative adoption level of Software as a Service along with the levels of financial, operational, human resource, and managerial time slack that were deployed due to that adoption. The overall adoption strength of SaaS was interpreted as a combination of the number of functional departments utilizing SaaS, the age of the first SaaS deployment, the budgetary allocation to SaaS contracts, the breadth of the value chain affected by SaaS, and the number of employees who utilize SaaS applications in their task environments. Table 5 summarizes the SaaS adoption characteristics for the seven cases while the detailed background data and analysis for each case may be found in Appendix A.

Table 5: Case-level interpreted and coded qualitative results

Case	SaaS adoption	FinSlack deployed	OpSlack deployed	HRSlack deployed	TimeSlack deployed
Alloy	High (3.0)	None (0.0)	Moderate-High (2.5)	Moderate (2.0)	High (3.0)
Boson	Low-Moderate (1.5)	None (0.0)	Low (1.0)	Moderate (2.0)	Moderate (2.0)
Covalent	High (3.0)	None (0.0)	None (0.0)	High (3.0)	High (3.0)
Dyne	Low-Moderate (1.5)	None (0.0)	None (0.0)	Low (1.0)	High (3.0)
Electron	None (0.0)	None (0.0)	None (0.0)	None (0.0)	None (0.0)
Fusion	Low (1.0)	None (0.0)	None (0.0)	High (3.0)	Low (1.0)
Gluon	Moderate-High (2.5)	None (0.0)	None (0.0)	Low (1.0)	Low (1.0)

The remaining constructs of the research model – IT Efficiency, IT Innovation, IT Performance, Firm Performance, Environmental Dynamism, and Control Variables – were assessed using the reliable and valid measures previously specified. However, because case method research does not typically provide sufficient sampling to conduct a standard causal analysis (Abbott 2004; Benbasat et al. 1987; Eisenhardt 1989b; Yin 2014), an index representing a relative value for each construct was computed as the geometric mean of the construct's indicators (Crawford 1987; Jalao et al. 2012). For the measurement of IT Ambidexterity, the absolute value of the geometric mean of IT Efficiency minus the geometric mean of IT Innovation was computed in a manner similar to that proposed by He and Wong (2004)). This ordering of equation components is also consistent with the established focus of IT supporting business strategy through information and process efficiency (Mithas et al. 2011).

For the measurement of Environmental Dynamism, the geometric means of turbulence, competitive intensity, and technological intensity were added sequentially and then examined individually. This collection of quantitative measures for each case, from Alloy through Gluon, will be examined further in cross-case and multi-case analyses.

Cross-Case Analyses

Data used for the cross-case analyses was primarily compiled from the individual case analyses and may be found in Tables 7-9. Table 7 contains the geometric means of Likert-scaled items directed toward Firm Performance and IT Performance. It also contains the geometric means of Likert-scaled items contributing toward IT Efficiency and IT Innovation along with two calculated measures for IT Ambidexterity. As with the Individual Case Analyses, IT Ambidexterity Equilibrium is a computed value (He and Wong 2004):

$$\left| \text{IT Efficiency}_{\text{geomean}} - \text{IT Innovation}_{\text{geomean}} \right|$$

However, this measure only captures equilibrium between efficiency and innovation constructs; it fails to address the requisite strength of each construct, which could have important implications when comparing cases. Combining both equilibrium and construct strength into a single index, IT Ambidexterity Full is computed as follows:

$$(\text{IT Efficiency}_{geomean} + \text{IT Innovation}_{geomean}) * (1-(\left|\text{IT Efficiency}_{geomean} - \text{IT Innovation}_{geomean}\right| / 5))$$

Adding the geometric means of IT Efficiency and IT Innovation results in a composite strength score, which is then multiplied by the absolute value of the differences to depreciate said strength by a disequilibrium component. Perfect equilibrium between efficiency and innovation results in an unchanged composite strength score while varying amounts of disequilibrium will reduce that score. This equation is in part based on the work of Fernhaber and Patel (2012)), who used latent congruence modeling to reflect both the levels and congruence of exploitation and exploration.

Table 7: Case-wise Structured Data Construct Indices

Case	Firm Performance	IT Performance	IT Efficiency	IT Innovation	IT Ambidexterity Equilibrium	IT Ambidexterity Full
Alloy	5.96	4.15	4.47	4.47	0.00	8.94
Boson	4.16	3.30	4.00	3.09	0.91	5.79
Covalent	6.19	4.00	4.47	4.31	0.16	8.49
Dyne	5.23	4.26	4.31	3.77	0.54	7.21
Electron	5.23	4.47	4.42	3.68	0.74	6.91
Fusion	2.00	3.96	3.98	3.91	0.07	7.79
Gluon	3.46	3.46	4.00	3.40	0.60	6.50

Table 8 contains interpreted and coded responses from the semi-structured interviews that gauge SaaS Adoption and Slack Deployment, which are then combined to yield a composite SaaS Resource Strength. SaaS Adoption is measured on a five-level scale ranging from one to three in half-point increments. Slack Deployment was derived from coded interview responses related to the transfer amounts of SaaS-induced slack from IT Efficiency to IT Innovation:

$$\left(\text{FinSlack} + \text{OPSlack} + \text{HRSlack} + \text{TimeSlack}\right)$$

Each of these slack transfer components are measured on a five-point scale ranging from one to three in half-point increments. While Slack Deployment would appear to have a maximum value of 12 if each slack form were at its peak, in fact Slack Deployment has a maximum value of 9 as monetary slack (FinSlack) was returned to the organization in all cases. SaaS Resource Strength combines SaaS Adoption and Slack Deployment in a multiplication that yields a composite index for multi-case comparisons:

$$\text{SaaS Adoption} * \left(\text{FinSlack} + \text{OPSlack} + \text{HRSlack} + \text{TimeSlack}\right)$$

The maximum value for SaaS Resource Strength is 27, which could only be achieved if all SaaS Adoption applications were replacement scenarios as operational slack (OPSlack) can only be generated under those conditions.

Table 8: Case-wise Semi-Structured Data Construct Indices

Case	SaaS Adoption	Slack Deployment	SaaS Resource Strength
Alloy	3.0	7.5	22.5
Boson	1.5	5.0	7.5
Covalent	3.0	6.0	18.0
Dyne	1.5	4.0	6.0
Electron	0.0	0.0	0.0
Fusion	1.0	4.0	4.0
Gluon	2.5	2.0	5.0

Table 9 contains the geometric means of Likert-scaled items related to individual vectors of environmental dynamism, a combined value for those vectors that was generated through addition, and control variables that represent a composite score for capital investment, R&D investment, advertising expenditures, and market share held by the primary product or service offered by the firm.

Table 9: Case-wise Moderator Construct Indices

Case	Turbulence	Competitive Intensity	Technological Intensity	Environment Combined	Control
Alloy	3.64	2.83	5.00	11.47	4.56
Boson	2.49	3.60	3.00	9.09	3.81
Covalent	3.48	4.00	3.13	10.61	5.73
Dyne	1.74	2.85	3.56	8.15	5.96
Electron	1.43	2.18	3.41	7.02	3.98
Fusion	3.64	3.24	4.23	11.11	3.30
Gluon	3.29	2.40	3.94	9.63	4.00

Operating from the coded, captured, or calculated data contained in these four tables, multi-case analyses was primarily examined both quantitatively and qualitatively through the use of radar charts (Barnes and Vidgen 2006). In the multi-case analysis phase, each chart contains seven radials indicating the seven cases under consideration and pairs of constructs or calculations to maintain clarity of those relationships. If two comparison measures have different scales, the lower measure has been increased commensurately such that both variables may be compared on the same scale.

Multi-Case Analyses

The first step in the multi-case analysis was to determine the effect of control variable investment on firm performance. Figure 2 demonstrates that while Alloy and Covalent possess the highest level of firm performance, they have different levels of control variable spending. Alloy spends far less as compared with its industry competitors to maintain nearly the same level of firm performance. An additional factor in this disparity might include rate of revenue growth, with Alloy at 20-25% and Covalent at 0% or less approximately. This information indicates that while Alloy would appear to be funding its growth through means other than control variable spending, at least a portion of Covalent's firm performance may be attributed to investments in capital, R&D, and advertising. Dyne and Fusion are unique in that their control variable investments exceed their respective levels of firm performance. Dyne, with 8-10% approximate revenue growth, showed that said growth was funded to a greater degree with those control variable investments than any other case present. However, any analysis of Fusion should be tempered with the knowledge that they are facing a budget crisis; even though control variable investments are at the industry mean, their level of firm performance substantially lags competitors. Electron invests capital at their industry mean while maintaining a higher level of firm performance. This condition may be attributed to their exclusive competitive environment in which customer switching costs are perceived to be high, thus offering a near-monopoly once a customer is acquired. The remaining cases, Boson and Gluon, demonstrate control variable spending at or below their industry mean when compared with direct competitors, which aligns with requisite levels of firm performance.

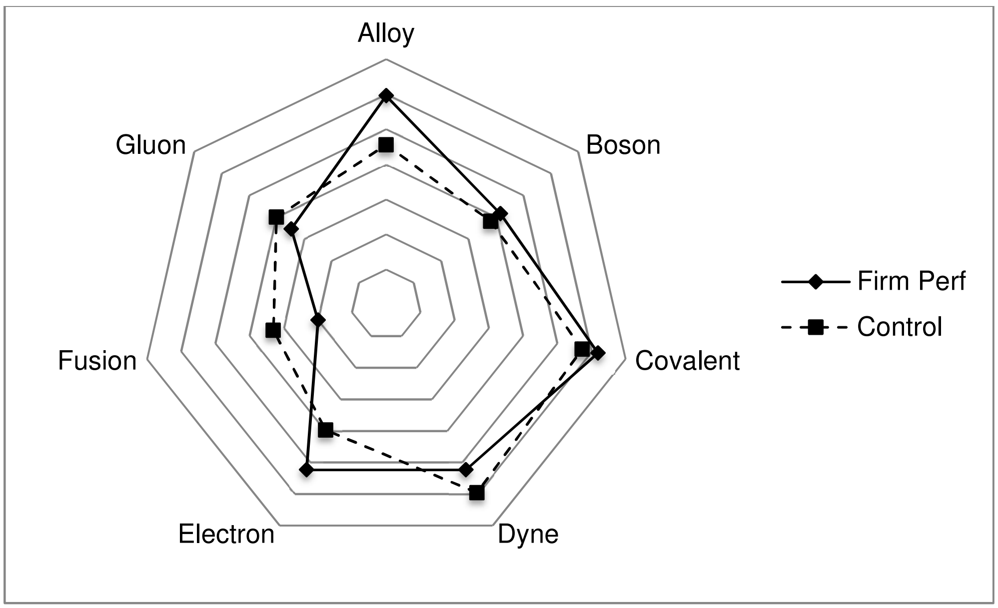

Figure 2. Multi-case Radar Chart: Firm Performance & Control Variable

The next phase of analysis, Figure 3, has compared Firm Performance with the aggregate measure of Environmental Dynamism. Because of scale dissimilarities, Firm Performance has been adjusted by a factor 15/7 to place its values in the same range as Environmental Dynamism. With the exception of Alloy and Boson, there is little coincidence between these two constructs. Fusion and Gluon are unusual in that the values for Environmental Dynamism exceed those specifying Firm Performance, but these organizations are unique in this research as the only two nonprofit institutions that are also under a significant degree of state-level influence or control.

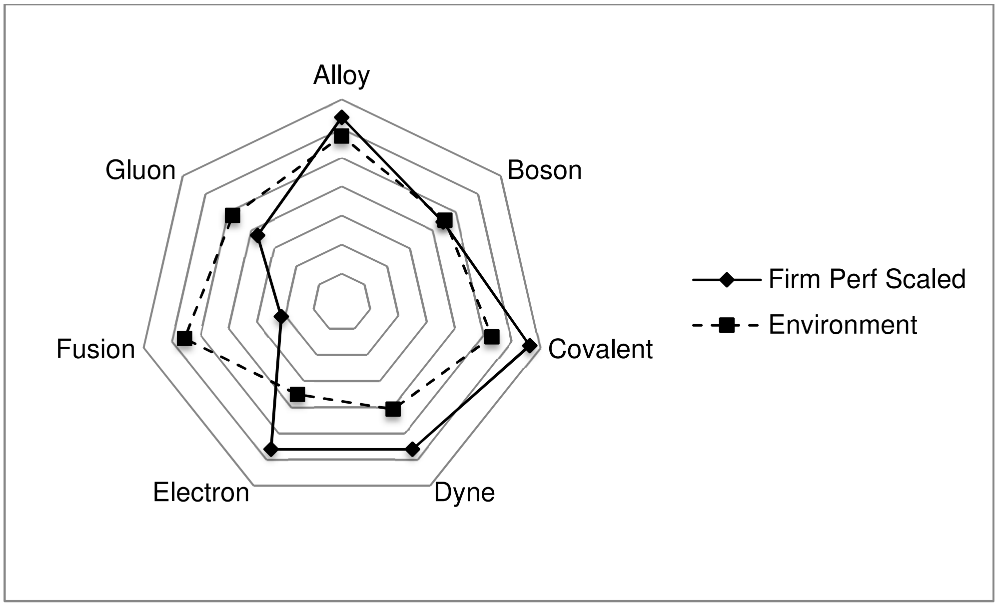

Figure 3. Multi-case Radar Chart: Firm Performance & Environment

Figure 4 displays the relationship between firm performance and IT performance. In this case, IT Performance values have been scaled by a 7/5 factor. Alloy and Covalent signify a situation where Firm Performance is measured at or above IT Performance. All other cases indicate a condition where IT Performance is perceived to be a higher level than Firm Performance. A deeper inspection of the underlying data shows that Alloy, Covalent, Dyne, and Electron have all four items that contribute to Firm Performance at a level of five or higher, a condition that may imply competitive advantage (Schoemaker 1990). However, only Alloy and Covalent have at least one of those items at a maximal level of seven. Following this stricter interpretation of competitive advantage, this research will consider these two cases as the exclusive representatives. Further analysis is required to understand why cases that lack competitive advantage at the firm level possess higher-valued perceptions of IT Performance.

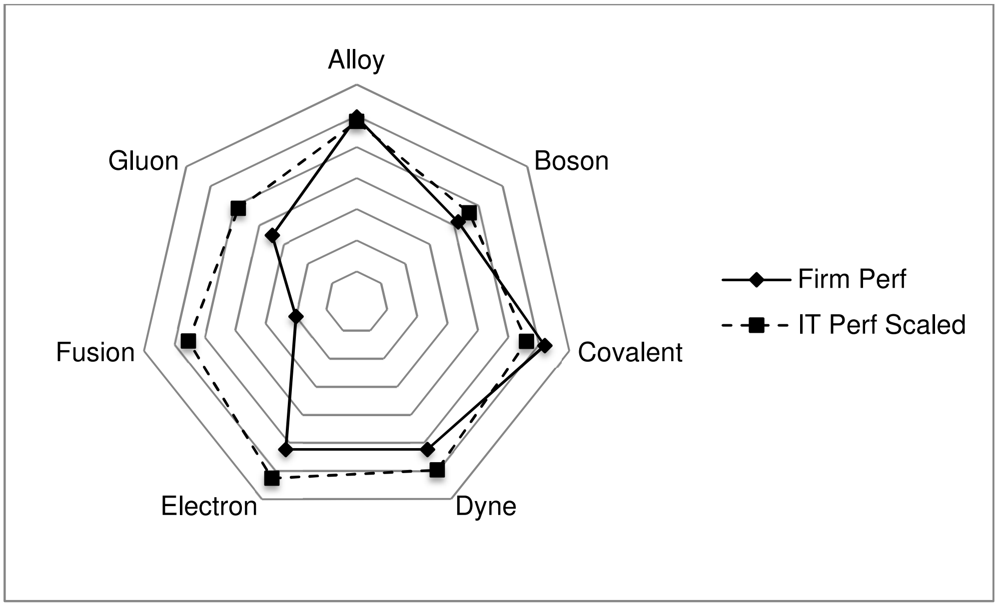

Figure 4. Multi-case Radar Chart: Firm Performance & IT Performance

The next comparison, Figure 5, overlays Firm Performance with IT Ambidexterity Full. Because of dissimilar scales, Firm Performance has been adjusted by a factor of 10/7 to equate it with the range of the IT Ambidexterity Full computed variable. Five of the seven cases demonstrate a nearly perfect coincidence of Firm Performance and IT Ambidexterity values. Two cases, Fusion and Gluon, show a disparity between Firm Performance and IT Ambidexterity in which ambidexterity exceeds performance, but it should be noted that these two cases are the sole representatives of public, nonprofit institutions of higher learning. Regarding Fusion, its budgetary situation may be a strongly limiting factor in achieving firm performance as demonstrated by weak strength components contributing toward IT ambidexterity despite near-perfect equilibrium. Case Gluon is also unusual in that an outside regulatory agency dictates considerable aspects of their strategy, which may act as a limiting factor on Firm Performance. But before we announce IT Ambidexterity as a proxy for firm performance, more analysis is in order.

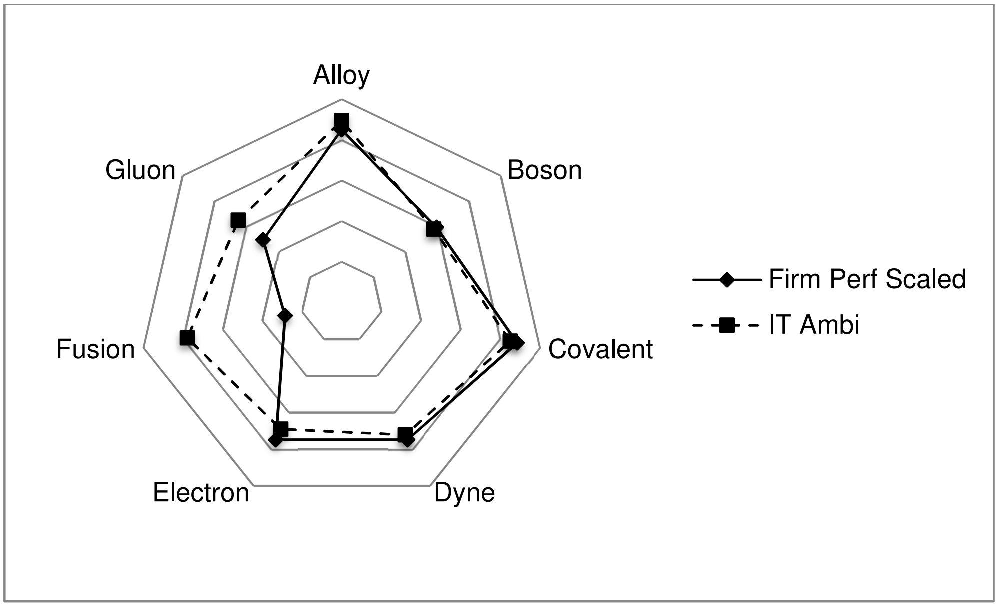

Figure 5. Multi-case Radar Chart: Firm Performance & IT Ambidexterity

The next radar chart, Figure 6 exemplifies the relationship between IT Ambidexterity Full and Environmental Dynamism. Scale dissimilarities have forced the adjustment of IT Ambidexterity Full values by factor of 15/10. With the lowest level of IT Ambidexterity Full, Boson showed a near coincidence between this computed value and Environmental Dynamism. This is consistent with Figure 3 in which Boson was the only for-profit organization where Firm Performance matched Environmental Dynamism. Cases Fusion and Gluon, as representatives of the public, nonprofit sector, also indicated the same concurrence between Firm Performance and the environment. However, Alloy and Covalent, with the highest levels of IT Ambidexterity and Firm Performance, also showed the highest levels of Environmental Dynamism. This data reinforced prior research of ambidexterity at the organizational level where greater environmental uncertainty offers a larger impact of ambidexterity on firm performance (as cited in O'Reilly and Tushman 2013b). Further evidence of the relationship between IT ambidexterity and the firm-level environment may be discovered visually in this chart, as denoted by the concentricity of the variable mapping.

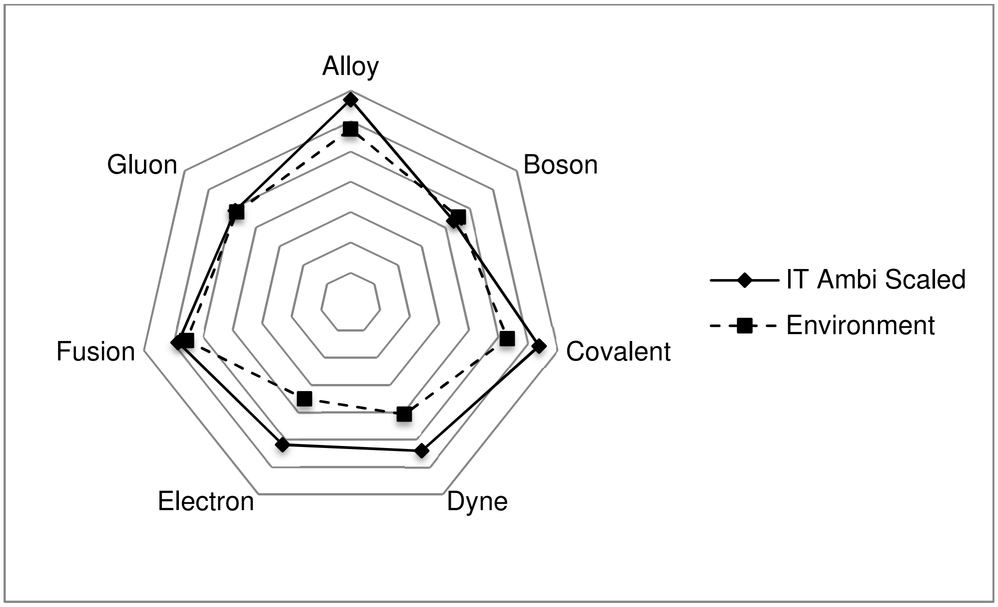

Figure 6. Multi-case Radar Chart: IT Ambidexterity & Environment

The relationship between IT Performance and IT Ambidexterity Full was explored next in Figure 7. Due to scale differences, IT Performance values were doubled. A close inspection of the underlying data showed that perceptions of IT ambidexterity exceeded those of IT Performance in only two cases, Alloy and Covalent. All other cases, those who lack the stringent qualifications of competitive advantage, presented values of IT Performance in excess of IT Ambidexterity Full. It should be noted that Case Fusion has near-equality between these two variables, but an underfunded IT function constrains its ability to effect downstream performance. These results confirm prior research and conceptualizations in which the IT function was predominantly associated with process efficiency (eg. Mithas et al. 2011) instead of a balance between efficiency and innovation. Yet, in an age of digital business strategy, IT ambidexterity may be more influential than IT performance alone.

With the data analyzed thus far, it is clear that IT ambidexterity, as measured with a combined component strength and equilibrium index, confirmed a stronger relationship with Firm Performance and Competitive Advantage that that offered by IT Performance. An adjustment of the research model is required to reflect direct relationships between IT Ambidexterity and IT Performance with Firm Performance, and with IT Ambidexterity being the stronger of the two. An additional construct, Competitive Advantage will be added as a downstream outcome linked to Firm Performance.

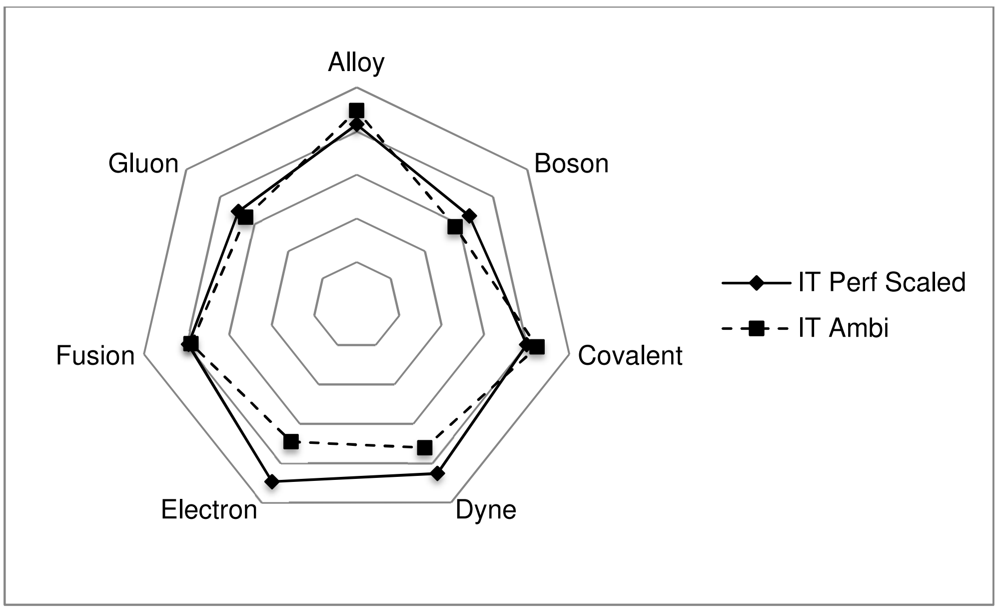

Figure 7. Multi-case Radar Chart: IT Performance & IT Ambidexterity

The next step in these analyses, Figure 8, compared IT Performance with one of its intrinsic components, IT Efficiency. As expected, there was a strong concentricity in the mapping between these two constructs, but only Dyne, Electron, and Fusion exhibited a near-perfect overlap of the two values. Cases Alloy, Boson, Covalent, and Gluon revealed IT Efficiency indices in excess of those for IT Performance. These cases represent a range of IT ambidexterity values, from the highest to the lowest, so it would not appear that this computed construct is related to the comparison of IT Performance with IT Efficiency. When conceptualized, this data showed that the components of IT ambidexterity, IT Efficiency and IT Innovation, do not exist on a continuum but rather are unique entities disconnected from a path-like relationship. Whether these constructs are incompatible, as presented by March (1991)), or orthogonal vectors of the same construct, as confirmed by Katila and Ahuja (2002)) in their research into new product development, will not be determined by this study.

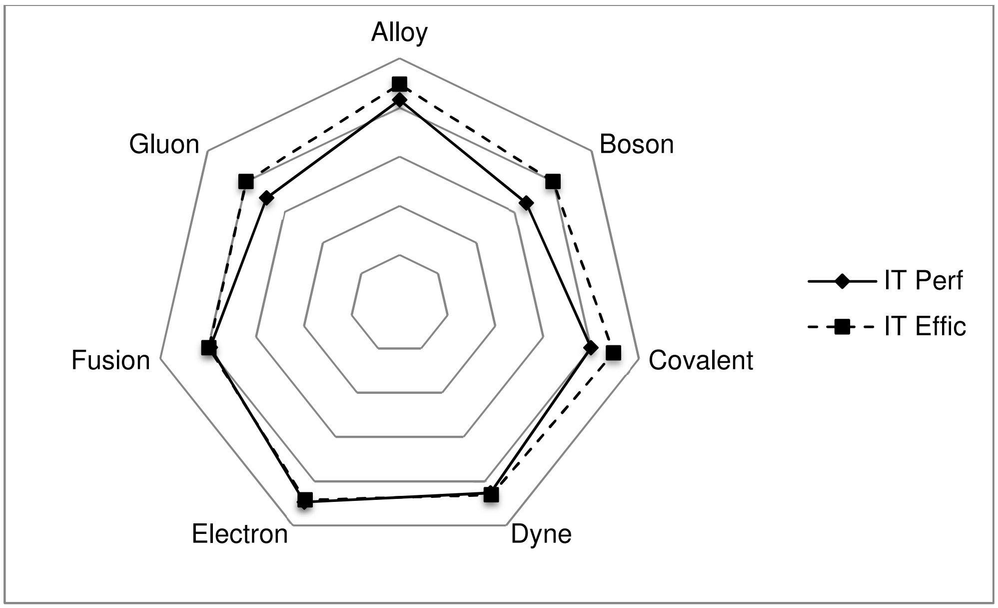

Figure 8. Multi-case Radar Chart: IT Performance & IT Efficiency

Similarly, Figure 9 showed a tightly concentric relationship between IT Performance and IT Innovation, and with direct overlap occurring in Fusion and Gluon. A close examination of the fundamental data revealed that IT Innovation exceeded IT Performance for Alloy and Covalent, the two cases representative of competitive advantage in their respective industries. IT Innovation lagged IT Performance for Boson, Dyne, and Electron, which had the greatest difference. Due to size constraints and a government-mandated digital transformation, Case Electron was dependent on a third-party software vendor to perform the bulk of their IT innovation. Referring to the individual case analyses, because of concerns about data availability and its relationship to patient care, they have a zero-level of SaaS adoption and, at the same time, the highest level of perceived IT Performance among these cases. This condition may be explained in terms of resource dependency theory (Pfeffer and Salancik 1978) whereby the organization maintained tight control over day-to-day, routine IT operations, thus achieving higher perceptions of IT Performance despite its weaker relationship with Firm Performance than IT ambidexterity.

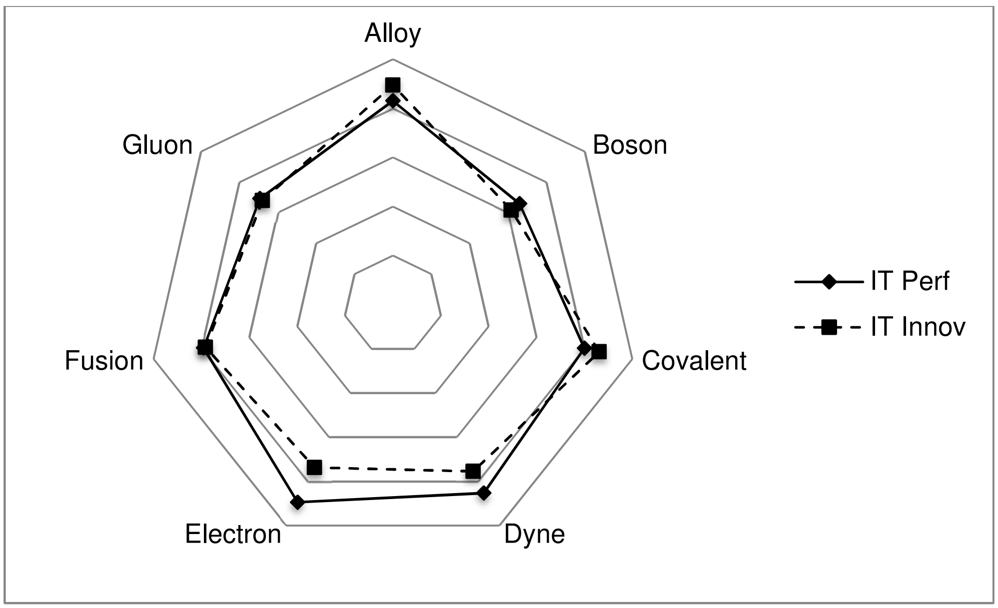

Figure 9. Multi-case Radar Chart: IT Performance & IT Innovation

Innovation has long been studied with regard to its association with the external environment (eg. Freel 2005; Özsomer et al. 1997; Russell and Russell 1992; Souder et al. 1998), and Figure 10 confirms prior research linking higher levels of IT innovation with greater instability in the environment (Xue et al. 2012). Values for the IT Innovation construct were tripled to place them on the same scale as Environmental Dynamism. Among these cases, Alloy, Covalent, and Fusion face the greatest levels of environmental dynamism, and consequently possess the highest degrees of IT Innovation. Referring to the fundamental data, Alloy, operating in the information technology industry, has the absolute highest level of IT Innovation, perhaps due to the increased lubricity between internal IT and revenue-generating products and services.

At the same time, Boson, also operating in the information technology industry, has the lowest level of IT Innovation and lowest level of IT ambidexterity despite a moderate finding of Environmental Dynamism. This discovery is contradictory given that Dyne, a consumer products company, has a lower level of Environmental Dynamism and a higher degree of IT Innovation. A deeper inspection using a performance-based case analysis will follow to better understand the Boson IT strategy.

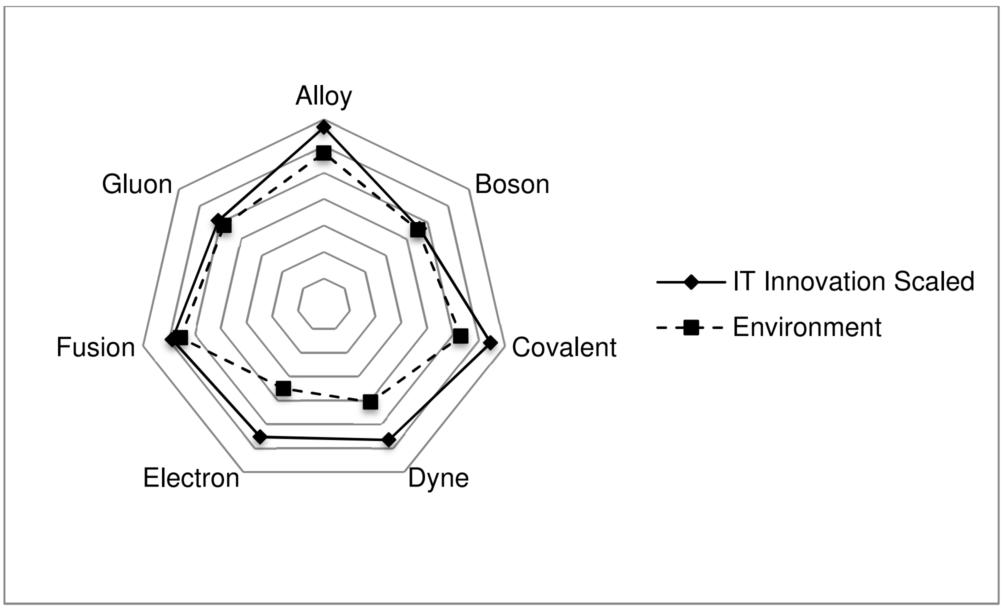

Figure 10. Multi-case Radar Chart: IT Innovation & Environment

Delving further upstream in the draft research model, Figure 11 tracks the relationship between IT Innovation and the SaaS-induced slack that had been converted to applied resources, termed as Slack Deployment. IT Innovation has been scaled by a factor 9/5. Cases Alloy and Boson, information technology companies with very different levels of IT Innovation, have the tightest configuration between IT Innovation and Slack Deployment. This mapping indicates that these organizations are using SaaS-induced resource slack as a primary means to fuel their respective levels of IT Innovation. The other cases demonstrate radically different levels of SaaS-induced slack and its conversion to IT Innovation. These results signify that the use of

SaaS to create and apply resource slack toward innovative projects is still one of managerial discretion (Chen et al. 2010). While the adoption of cloud computing and SaaS is expanding at a rapid pace (Economist_Intelligence_Unit 2015), its application as a central component of IT strategy has not yet reached the point of duplication through competitive, mimetic, or normative isomorphism (DiMaggio and Powell 1983).

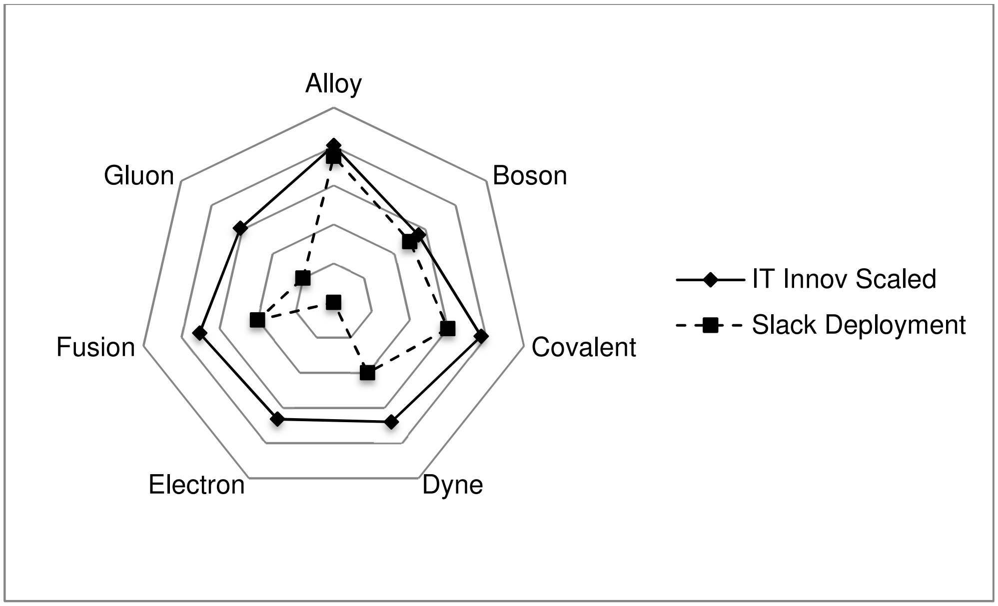

Figure 11. Multi-case Radar Chart: IT Innovation & Slack Deployment

With the relationship between SaaS-induced slack resource deployment and IT Innovation having been explored in the individual case analyses and in the previous radar chart, Figure 12 examines the antipodal relationship between IT Efficiency and Slack Deployment. As with IT Innovation, IT Efficiency values were multiplied by 9/5 to place them on the same range as Slack Deployment. As hypothesized in the draft research model, the majority of resource slack generated by the adoption of SaaS was redirected toward innovation instead of being retained in IT Efficiency. Case Alloy is notable in their alignment between these two constructs, but they have a unique relationship with their SaaS vendor that allows them to modify the SaaS business process software such that custom functionality supporting efficiency and productivity is created in-house and then hosted in the cloud. In this way, Alloy is using SaaS to increase both IT Efficiency and IT Innovation.

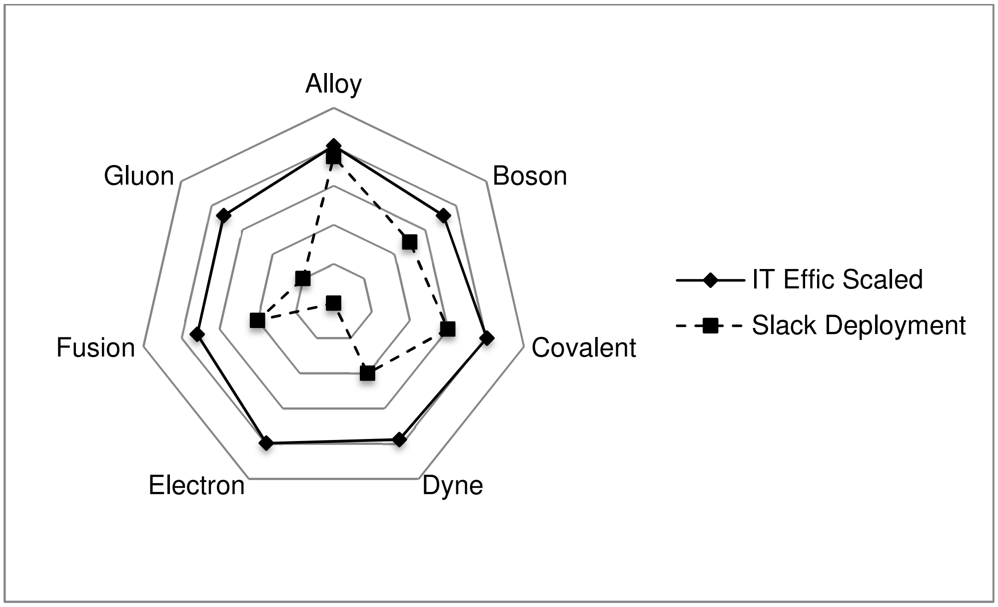

Figure 12. Multi-case Radar Chart: IT Efficiency & Slack Deployment

With an analysis conflating IT Innovation and Slack Deployment in hand by way of Figure 11, the radar chart in Figure 13 checks the final upstream pathway, that of linking IT Innovation with SaaS Adoption levels. SaaS Adoption indices were amended by a factor of 5/3 to match them with IT Innovation values. For those cases where IT Innovation is greater than SaaS Adoption, Boson, Dyne, Electron, and Fusion, it may be surmised that innovation funding was generated through means in addition to, or as with Electron, other than the adoption of SaaS. With SaaS Adoption values higher than those of IT Innovation, Alloy, Covalent, and Gluon demonstrate the nature of imperfect slack resource transfer given that the dominant forms of SaaS-induced slack are IT human resources and IT managerial time. Operational slack only appears in replacement scenarios, and while its transfer from IT Efficiency to IT Innovation is more perfect and it may achieve at least temporarily a stronger relationship with firm performance in contradiction to prior resource-based research into IT as presented in the meta-analysis by Piccoli and Ives (2005), it is the weakest form of SaaS-induced slack.

Human resource slack, conceptualized as recoverable slack (Bourgeois 1981; Lant 1986; Sharfman et al. 1988; Tan and Peng 2003) has imperfect transfer characteristics due to the recovery processes. Moving human resources from IT Efficiency to IT Innovation requires either additional training or a human resource replacement route, both of which involve time and budgetary expenditure, an assertion confirmed by the key informants of Alloy and Covalent during the interview stage. IT managerial time also incurs a resource loss through a reduction of decision concentration because of split responsibilities, either between IT Efficiency and IT Innovation or between multiple simultaneous innovative projects.

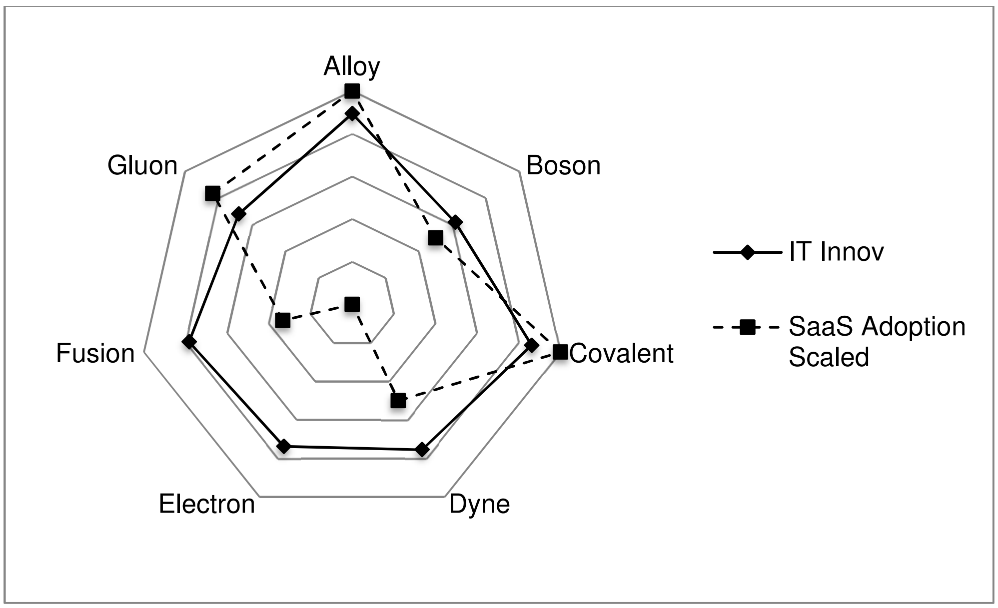

Figure 13. Multi-case Radar Chart: IT Innovation & SaaS Adoption

The relationship between IT Innovation and the external environment was assessed in Figure 10, but Figure 14 lifts the veil of IT Innovation in the aggregate to explore the potential effects of the environment on SaaS-induced slack deployment between IT Efficiency and IT Innovation. Slack Deployment values were scaled by a factor of 15/9 to align its range with that of Environmental Dynamism. Alloy, Boson, Covalent, and Dyne expressed a close relationship between environmental dynamism and the deployment of slack resources, which are in concert with IT Innovation and the environment. Case Electron, with a zero-level adoption of SaaS, is devoid of that connection. Fusion and Gluon demonstrate again the differential nature of public, nonprofit institutions by having weak levels of Slack Deployment despite facing high levels of environmental dynamism.

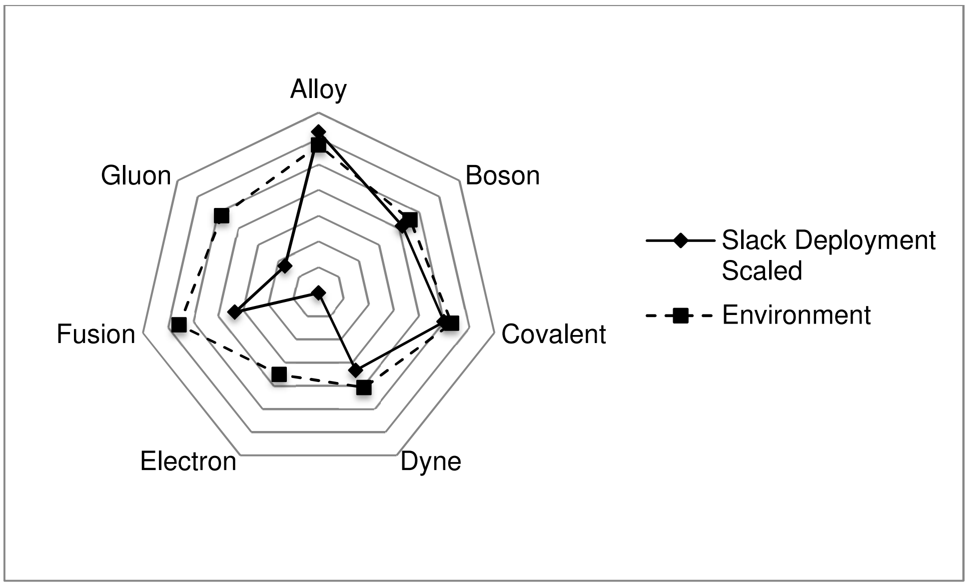

Figure 14. Multi-case Radar Chart: Slack Deployment & Environment

The final chart in the multi-case analyses, Figure 15 examines the link between SaaS Adoption and the environment. SaaS Adoption values were multiplied by five to conflate them with the scale for Environmental Dynamism. It is evident from the mapping of this chart that the environment has little to no effect on the decision to adopt SaaS business process applications, reinforcing the previously-established argument about the lack of competitive, mimetic, or normative isomorphism. Taking this notion one step further, these results buttress the use of case method research to study SaaS as it is still in a stage of phenomenological evolution.

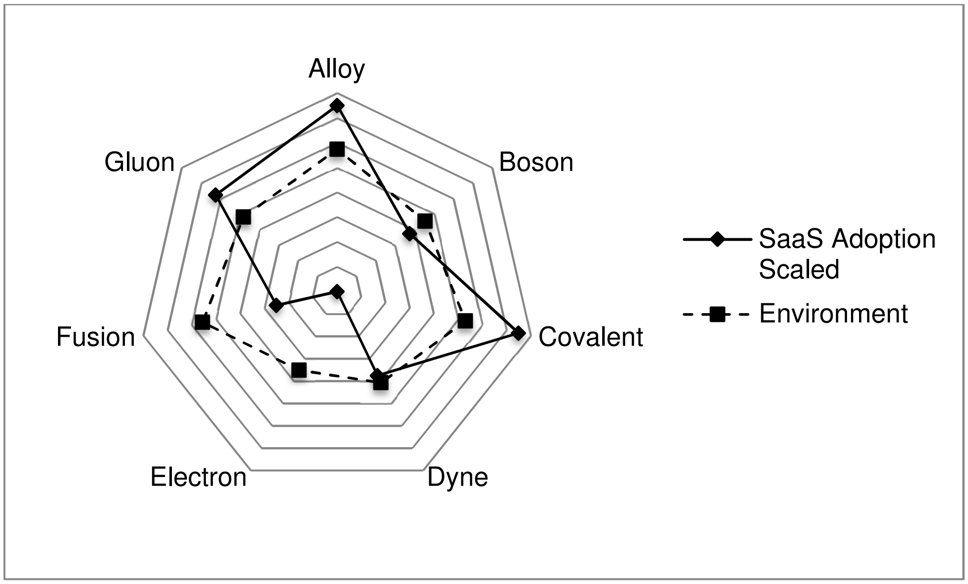

Figure 15. Multi-case Radar Chart: SaaS Adoption and Environment

Performance-based Case Analyses

The final two radar charts divide the cases into two groups: 1) those possessing competitive advantage in their respective industries (Alloy and Covalent), and 2) those with lower levels of firm performance but whose SaaS Adoption is above zero (Boson, Dyne, and Gluon). Cases Electron and Fusion were exempted from this analysis because of zero-adoption of SaaS in the former and a unique financial situation in the latter. Unlike the prior radar charts where cases are represented on the radials and constructs as the chart lines, these figures present constructs as the radials and cases as the chart lines for reasons that will become clear. All intrinsic variable values, whether measured on a five or seven-point scale were adjusted to match with IT Ambidexterity Full as its 10-point range established the maximum scope.

Figure 16 establishes the comparison between the highest performing cases, Alloy and Covalent. Before examining the data-point mapping, it should be noted that these two firms were in different industries (information technology and consumer goods – food and beverage), had diverse numbers of employees (3,000 vs. 100,000), operated with dissimilar revenue figures

($5B vs. $30B), and functioned with radically distinctive revenue growth rates (20-25% vs. 0% per annum). Yet, referring to Figure 16, it is apparent that the values for Firm Performance, IT Performance, and IT Efficiency are not just concentric, they are veritable doppelgangers. Levels of IT Innovation and IT Ambidexterity Full had variations, with Alloy holding slightly higher levels of both due to their relative ease of transferring resources between IT Efficiency and IT Innovation. An understanding of their respective digital business strategies further illuminates this distinction: Alloy, in the information technology field, used the slack created by SaaS adoption to invest more resources in product and service design whereas Covalent, in the consumer goods sphere, used these slack resources to engage in higher levels of big data collection and analysis. Both firms have high unscaled levels of SaaS Adoption (Alloy = 22.5, Covalent = 18). Continuing the examination of Figure 16, both firms had similar levels of environmental Turbulence, but Covalent was faced with relatively high levels of Competitive Intensity while Alloy encountered the highest measurable level of Technological Intensity. Despite the differences in these environmental vectors, both key informants perceived high intensities of overall Environmental Dynamism (Alloy = 11.47, Covalent = 10.61). One key difference may be found in Control Variable investment, as Covalent may be using larger expenditures in capital investment, advertising, and research and development to offset low revenue growth while still maintaining competitive advantage in a multiplicity of geographic and product markets.

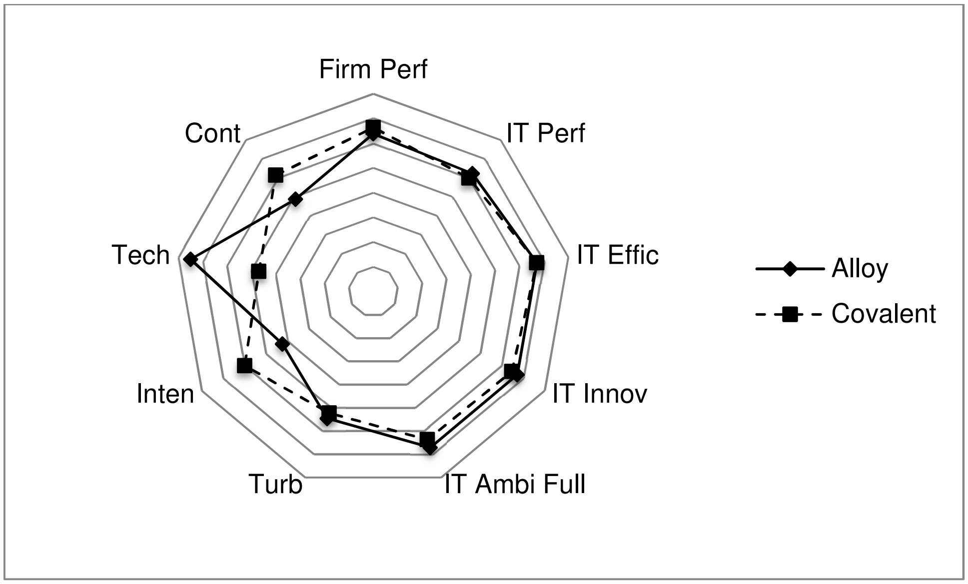

Figure 16. Overall Indicators Radar Chart: Higher Performing Cases

The final comparative radar chart, Figure 17 demonstrates what are essentially the dissimilarities between the lower performing cases. These cases are in different industries, and they have varying amounts of revenue along with diverse numbers of employees and distinctive annual revenue growth rates.

Among these organizations, Dyne had the highest perceived levels of Firm Performance, IT Performance, IT Efficiency, IT Innovation, and IT Ambidexterity Full while having nearly the same unscaled SaaS Adoption value as Boson and Gluon (Dyne = 6, Boson = 7.5, Gluon = 5). Its Firm Performance, however, may be affected by strong investment in Control Variable spending, an amount equal to that of Covalent despite facing a substantially lower degree of overall Environmental Dynamism as perceived by the key informant. It should be noted that Dyne's Sales informant perceived environmental dynamism level to be much higher at 11.06, an amount greater than Covalent and almost equal to Alloy. With Dyne as the leader, all three organizations have an increased focus on IT Efficiency over IT Innovation and yet their IT Efficiency levels are still lower than those found in Alloy and Covalent. This data indicates that the adoption of SaaS does not depreciate perceptions of IT Efficiency but rather does the opposite.

Case Boson is unusual in that it operated in the information technology industry yet it possessed the lowest levels of IT Performance, IT Efficiency, and IT Innovation. When this data is integrated with their low revenue growth rate and a relatively small number of large customers whose contractual obligations imply high switching costs (Porter 2008), it may be surmised that Boson's IT strategy is aligned with a corporate business strategy, that of the "cash cow" as defined in the Boston Consulting Group's strategic quadrant matrix (Day 1977). Rather than adopt a digital business strategy, Boson would appear to be focused on the preservation of a steady revenue stream.

Only Dyne, the performance leader amongst this group, had a professed digital business strategy, one which encompassed a fully integrated global supply chain for one of its product lines. The purpose of this endeavor, however, was to increase efficiency and productivity through the implementation of a just-in-time manufacturing system. While this action served its purpose, it does not necessarily create differential value through the leveraging of digital resources, which is a common theme for the lower performing organizations.

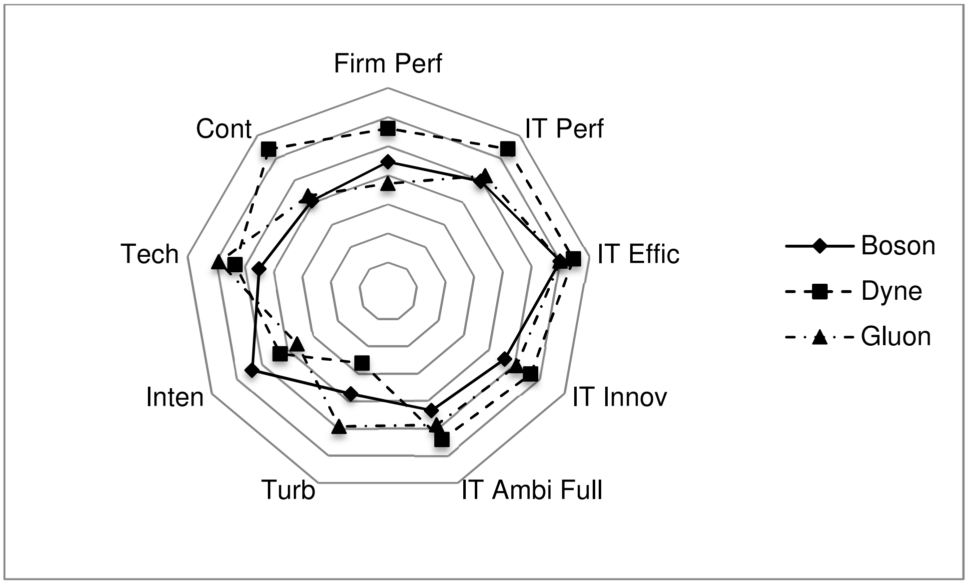

Figure 17. Overall Indicators Radar Chart: Lower Performing Cases

Revised Research Model

Taking into consideration the analyses presented thus far, a revised research model has been devised. Direct evidence from interview data, which was validated through reliability measurements, established the relationship between SaaS Adoption and the creation of all four forms of slack: 1) financial or monetary, 2) operational, 3) human resource, and 4) managerial time. This finding confirmed Hypotheses 1a through 1d.

In every case, monetary slack was returned to the organization while operational, human resource, and managerial time were retained by the IT function, partially confirming Hypothesis 2. Monetary and operational forms of slack were only created in those cases were SaaS applications were replacing existing, internally-hosted software. In addition, while replacing components of IT Efficiency, the adoption of SaaS did not deleteriously impact the perceived efficacy of that function but rather raised it.

The retained slack created by SaaS adoption was redeployed from IT Efficiency to IT Innovation in varying amounts, ranging from the weakest (operational) to the strongest (managerial time), partially confirming Hypothesis 3.

The amount of redeployed slack influenced the equilibrium between IT Efficiency and IT Innovation, confirming Hypothesis 4, and this IT ambidexterity was more strongly related to Firm Performance than that of IT Performance, partially confirming Hypothesis 5 and confirming Hypothesis 6. This finding also indicates the need for the addition of a new, stronger relationship, one connecting IT Ambidexterity directly to Firm Performance in addition to the lesser IT Performance-to-Firm Performance pathway.

Disequilibrium in IT Ambidexterity, with a weighting toward IT Efficiency, resulted in higher perceptions of IT Performance despite its weaker relationship with Firm Performance. In a counter-intuitive fashion, disequilibrium in IT Ambidexterity also led to generally lower ratings for both IT Efficiency and IT Innovation individually.

When sufficient IT Ambidexterity combined with suitable overall budgeting for IT is achieved, a stringent form of competitive advantage may result, a further confirmation of the new relationship between IT Ambidexterity and Firm Performance. Investment in capital, research and development, and advertising may contribute to firm performance along with the brand value of holding a strong market share, but it is unclear as to whether these expenditures affect the ability of an organization to achieve competitive advantage. Industry, number of employees, revenues, and revenue growth rate appear to circumstantially affect the composition of an IT strategy, but they do not seem to directly influence SaaS adoption and its subsequent organizational effects.

Environmental dynamism did not appear to be a factor in the decision to adopt SaaS, but it did seem to impact the migration of resources from IT Efficiency to IT Innovation, thus disconfirming Hypotheses 7a-d while confirming Hypothesis 8 and splitting it across three forms of slack.

Refer to Figure 18 for a revised research model that incorporates this knowledge and displays an understanding through the use of weighted lines.

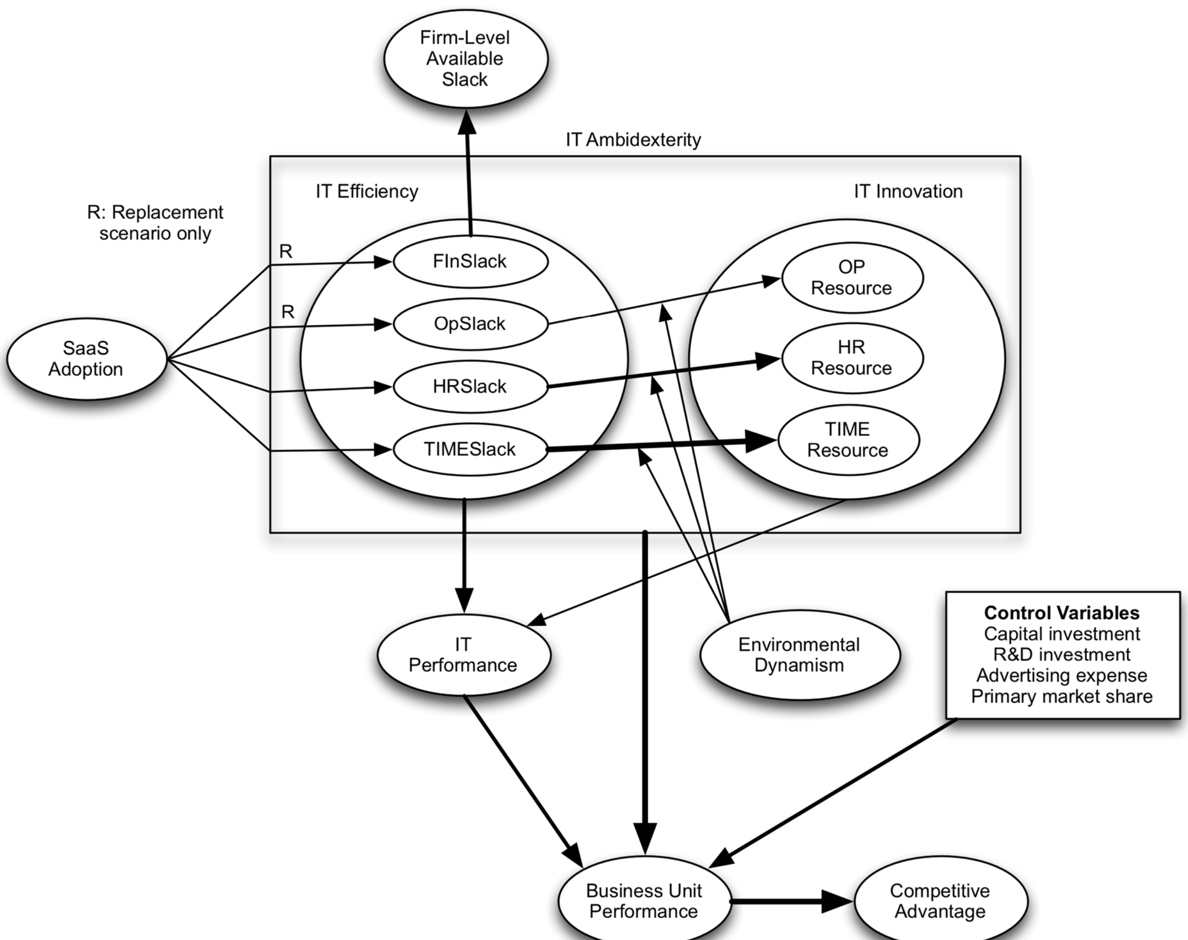

Figure 18. Revised research model

DISCUSSION, LIMITATIONS, AND FUTURE RESEARCH

Discussion

This research project was undertaken to explore how a key external trend of digital business strategy, SaaS, influences an organization's volume of IT innovation, and to confirm the feasibility of slack being produced as a function of externalized exploitation and being absorbed as an attribute of increased exploration at the functional level. The analysis, which combined both semi-structured interview data with a perceptual survey instrument toward a mixed qualitative-quantitative evaluation format, resulted in a number of discoveries. First, the adoption of SaaS as measured in terms of depth and breadth of business process support, does have the potential to produce four types of slack within the IT function: 1) financial in monetary form, 2) operational as computing and networking hardware and software, 3) human resources as non-managerial time, and 4) managerial time. This finding was confirmed in direct evidentiary testimony from all cases except Electron, who had no adoption of SaaS. In a linear, positive relation the production and deployment of slack is associated with the adoption level of SaaS, a finding strongly confirmed in the semi-structured interview data from Cases Alloy and Covalent, the two firms with a clear digital business strategy. Case Alloy offered a 3.0:7.5 ratio of SaaS-induced slack production to slack deployment while Case Covalent indicated a 3.0:6.0 ratio for the same relationship.

The first two types of slack, financial and operational, only appear if the SaaS application is replacing an existing business support system because that is the only scenario in which there are extant monetary expenditures and operational resources. While slack operational resources may be instantiated in either IT Efficiency or IT Innovation, the cost reduction generated by SaaS adoption was returned to the organization in all cases, as confirmed by direct interview testimony by all SaaS adopters, thus discounting the presence of agency theory at work (Eisenhardt 1989a; Jensen and Meckling 1976) through the creation of budgetary slack (Onsi 1973). We find this outcome to be the result of increased information symmetry between IT and other functional departments (Dunk 1993) who participate in the SaaS contracting processes. The remaining two types of slack, human resources and managerial time, are produced regardless of the SaaS adoption scenario because they rely on extant personnel within IT, and they are redistributed in terms of person/hours from IT Efficiency to IT Innovation to a greater degree in higher-performing firms, namely Cases Alloy and Covalent. However, all SaaS adopters shared the outcome of human resource and managerial time slack creation and deployment. Our interpretation of the data is that the adoption of SaaS is linked to the creation of multiple types of slack resources, higher levels of IT-sourced innovation, and reduced information asymmetry between IT and the firm at large.

Second, the aggregate level of environmental dynamism appears to have a substantial moderating effect on the redistribution of slack resources from exploitation to exploration activities. Contextual qualifications should be considered for Case Dyne because of mismatched perceptions of the external environment, and Case Electron, whose IT ambidexterity is predominantly provided by an external vendor.After redacting these exceptions, this data is consistent with prior research in which higher levels of environmental instability have been associated with strategic outcomes (Choe 2003; Lu and Ramamurthy 2004; Mithas et al. 2013; Xue et al. 2012).

Another finding of this study is that high levels of competitive intensity, as opposed to similar levels of technological intensity, seem to have the same effect on digital business strategy, i.e., they work to influence decisions and actions that produce higher levels of IT

Innovation. The equivalence between competitive intensity and technological intensity is interesting because these two dimensions of the environment have very different impacts on the organization. Competitive intensity is marked by frequent competitive actions regarding price, discounts, warranty, and product differentiation – all aspects addressed by the sales and marketing function. Responses to these types of competitive actions have a higher frequency but a limited impact on the organization at large. Conversely, technological intensity, marked by technological developments and breakthroughs, involves a lower frequency of competitive actions but those with a higher impact on the organization, particularly in terms of organizational learning and assimilation (Dodgson 1993).

Third, increased activities in IT Innovation are related to a movement toward equilibrium in IT ambidexterity, and it is this balance between exploitation and exploration within the IT function that contributed to organizational performance. The notion that IT has predominantly been related to efficiency and productivity outcomes has been presented in prior research (e.g. Melville et al. 2004b; Mithas et al. 2011), and the idea that technological investments in efficiency or innovation have different impacts on firm performance has been explored (Subramani 2004). This prior work implied that greater investments in IT-led innovation would increase ambidextrous equilibrium within that function, and that divesting certain assets from IT Efficiency without depreciating organizational business process knowledge, as would occur with traditional outsourcing (Kakabadse and Kakabadse 2005), would not deleteriously impact firm performance, two findings that we confirm. Further, we find that digital business strategies underpin a drive toward increased IT Innovation with higher-performing firms who operate within environments that provide the opportunity to capitalize on that innovation. Caution must be exercised though before concluding that IT ambidexterity is a proxy for organizational ambidexterity.

Fourth, our findings indicate that a greater disequilibrium in IT ambidexterity is positively related to higher perceptions of IT Performance and, in a counter-intuitive fashion, lower perceptions of firm performance. This seemingly antipodal relationship between these three constructs may be understood by examining the intra-organizational mechanisms that occur when adopting SaaS to replace traditional business process support applications. The adoption of SaaS under those circumstances is essentially a loss of control in IT budgeting, reinforced by the transfer of monetary slack to the organization. This externalization of locus of control (Brownell 1981) in the budgeting and subsequent application management processes may deteriorate views of IT performance without directly affecting perceptions of firm performance. Our finding is consistent with prior research into chief executive locus of control and firm performance relationships (Boone et al. 1996) but with the addition of a single hierarchal layer. An alternative explanation could be that maintaining higher levels of IT investment creates an impression of IT performance that is disconnected from firm performance because of strategic alignment and infrastructure issues (Devaraj and Kohli 2003; Sabherwal and Jeyaraj 2015). Complicating matters further is the notion that as IT task goals venture from process efficiency into innovation, greater project uncertainty is encountered (Tatikonda and Rosenthal 2000) with concomitant risk escalation and initially reduced perceptions of overall performance due to the nascent stage of digital business strategy maturity. In this way, SaaS adoption is related to corporate entrepreneurship, or intrapreneurship, and the involvement of IT therein (Chen et al. 2015).

Fifth, the adoption of SaaS is not the only means by which a digital business strategy, and an attendant drive toward IT ambidexterity, may be funded and realized. We find that SaaS adoption is a tactic that produced slack resources for redeployment toward innovative activities, provided that the friction induced by management, control, and governance was addressed and accepted on the part of leadership. In this way, the adoption of SaaS is a method to generate the ‘patient money’ found necessary to fund corporate entrepreneurship (Kanter 1986). Yet, the financial fuel to power such intrapreneuring activities may come from different sources such as profit redistribution or venture financing (Wolcott and Lippitz 2007). Each of these other avenues, however, incur an additional cost on the firm, thus depreciating the value of innovation before it becomes ingrained in a revenue model. We find these additional costs as having the potential to construct the threshold dividing higher-performing firms from lower-performing firms as indicated by SaaS adoption levels. This finding affirms the idea that SaaS adoption is a low-cost means to achieve higher levels of IT innovation, IT ambidexterity, and ultimately firm performance.

Limitations

While case method research is well suited to explore the minutiae related to situations of phenomenological recency, those that require exploration over confirmation (Benbasat et al. 1987), it has inherent methodological limitations, including issues related to generalization, hypotheses testing, the scope of validity, theory building, and a bias toward verification through interpretivism versus positivist empiricism (Abbott 2004; Gerring 2006).

The cases chosen for this research project were predominantly paired so as to enhance the confirmation of feasibility through an intra-industry examination. As such, two firms representing different dimensions of information technology, consumer goods, and public nonprofit educational services were evaluated along with a single case containing null values for SaaS adoption. However, the mixed-mode qualitative and quantitative discovery processes revealed substantial intra-industry variations that, while important for the outcomes of this study, make generalization of the results difficult to advance beyond this scope.

Case method research is not excluded from theory building (Eisenhardt 1989b), but it is made more difficult because of its deep-versus-broad and heterogeneous-versus-homogeneous affinities. At the same time, this research study relied on long-established theories and charters, including slack (Cyert and March 1963), ambidexterity (March 1991), and strategic frameworks (Barney 1991; Porter and Millar 1985). The course of this research discovered new relationships and refinements related to the propositions of digital business strategy (Bharadwaj et al. 2013), but there was no attempt to advance any new theories regarding the digital enterprise thus limiting its exposure to theory building.

The design and execution of this research was undertaken to minimize the potential for bias while preserving the investigation into hypothesized mechanisms. For that reason, content analysis was chosen for its methodological strengths, including the development and assessment of a research model, construct measurement, multiple coders, and reliability calculations that accommodate a variety of data configurations (Krippendorff 2012; Neuendorf 2002). In addition, measurements of four dimensions of firm performance, capital investment, research and development spending, advertising expenditures, and environmental dynamism were collected from two respondents of each firm where possible, and then tested using the Wilcoxon matched-pairs regimen – in all cases, a failure to reject the null hypothesis was the result. However, a measurement of IT ambidexterity, consisting of efficiency and innovation components, and overall IT performance requires a functional view that encompasses both exploitative and exploratory activities. For that reason, these critical measures come from a single key informant, the CIO, which exposed this research to the potential for common method bias. In recognition of this conceivable influence, the dramaturgical method of research interviewing was rigorously employed (Myers and Newman 2007), but one must still consider the prospect of consistency motif, illusory correlations, social desirability, mood state, and/or transient mood state to affect responses to the measures (Podsakoff et al. 2003).

Future Research

Extending this research along the same hypothetical premises to increase generalizability could involve another Small-N analysis (Abbott 2004) using a wider variety of cases that represent an expansion of geography both within and outside of the United States, an increase in the number of industries, a larger number of informants from each organization, and a greater range of environmental dynamism and SaaS adoption contexts. Ultimately, a number of cases sufficient to offer statistical validity and reliability using a Large-N technique such as PLS-SEM (Marcoulides et al. 2009) would be desirable as it could result in numerical path relationships.

Continuing the research stream into the relationship between IT ambidexterity, environmental dynamism, and firm performance, future research could examine the managerial decisions formulated and their subsequent effects related to mismatched perceptions of the environment between IT and other functional departments, thus expanding on the work by Mithas and Rust (2016). This prospective work may be structured as a time-series process flow and modeled in a system dynamics cycle to understand the potential degradation in firm performance over time (Perlow et al. 2002).

Another recommendation for future research involves the study of cloud computing and SaaS in terms of acquired and divested knowledge (Nonaka 1994; Spender 1996), both for the IT function, other functional departments, and the firm in general. The adoption of SaaS is linked to a reduction in staffing for routine operation, maintenance, and support, which implies a loss of knowledge within IT (Xin and Levina 2008). At the same time, cloud-based business process application support offers a knowledge inflow due to the multi-tenant nature of SaaS and the propensity of vendors to roll out continuous upgrades (Han 2011b). Tracking the quantity and value of these inter- and intra-organizational knowledge flows (Appleyard 1996; Kogut and Zander 1992; Zander and Kogut 1995) may provide additional depth in describing the relationship between SaaS and competitive advantage.

A final suggestion for continued study is the use of IT ambidexterity in place of IT performance when investigating relationships between the IT function and firm performance (e.g., Gregory et al. 2015; Leonhardt et al. 2017). Our findings indicate that IT ambidexterity has a closer relationship with firm performance than does IT performance, and this pathway should be explored in detail to understand that relationship and the contexts under which it is applicable.

REFERENCES

Abbott, A. 2004. "Methods of Discovery: Heuristics for the Social Sciences (Contemporary Societies),").

Anderson, R. C., and Reeb, D. M. 2003. "Founding ‐ Family Ownership and Firm Performance: Evidence from the S&P 500," *The journal of finance* (58:3), pp. 1301-1327.

Ang, S., and Straub, D. W. 1998. "Production and Transaction Economies and Is Outsourcing: A Study of the Us Banking Industry," *MIS Quarterly*), pp. 535-552.

Appleyard, M. M. 1996. "How Does Knowledge Flow? Interfirm Patterns in the Semiconductor Industry," *Strategic Management Journal* (17:S2), pp. 137-154.

Aral, S., and Weill, P. 2007. "It Assets, Organizational Capabilities, and Firm Performance: How Resource Allocations and Organizational Differences Explain Performance Variation," *Organization Science* (18:5), p. 763.

Armbrust, M., Fox, A., Griffith, R., Joseph, A. D., Katz, R., Konwinski, A., Lee, G., Patterson, D., Rabkin, A., Stoica, I. O. N., and Zaharia, M. 2010. "A View of Cloud Computing," *Communications of the ACM* (53:4), pp. 50-58.

Auh, S., and Menguc, B. 2005. "Balancing Exploration and Exploitation: The Moderating Role of Competitive Intensity," *Journal of Business Research* (58:12), pp. 1652-1661.

Barnes, S. J., and Vidgen, R. T. 2006. "Data Triangulation and Web Quality Metrics: A Case Study in E-Government," *Information & Management* (43:6), pp. 767-777.

Barney, J. 1991. "Firm Resources and Sustained Competitive Advantage," *Journal of Management* (17:1), p. 99.

Benbasat, I., Goldstein, D. K., and Mead, M. 1987. "The Case Research Strategy in Studies of Information Systems," *MIS Quarterly* (11:3), pp. 369-386.

Benlian, A., and Hess, T. 2011. "Opportunities and Risks of Software-as-a-Service: Findings from a Survey of It Executives," *Decision Support Systems* (52), pp. 232-246.

Benner, M. J., and Tushman, M. L. 2003. "Exploitation, Exploration, and Process Management: The Productivity Dilemma Revisited," *Academy of Management Review* (28:2), pp. 238-256.

Bharadwaj, A., El Sawy, O. A., Pavlou, P. A., and Venkatraman, N. 2013. "Digital Business Strategy: Toward a Next Generation of Insights," *MIS Quarterly* (37:2), pp. 471-482.

Bharadwaj, A. S., Bharadwaj, S. C., and Konsynski, B. R. 1999. "Information Technology Effects on Firm Performance as Measured by Tobin's Q," *Management Science* (45:7), pp. 1008-1024.

Boone, C., Brabander, B., and Witteloostuijn, A. 1996. "Ceo Locus of Control and Small Firm Performance: An Integrative Framework and Empirical Test*," *JOURNAL OF MANAGEMENT STUDIES* (33:5), pp. 667-700.

Bourgeois, L. J. 1981. "On the Measurement of Organizational Slack," *Academy of Management Review* (6:1), pp. 29-39.

Bourgeois, L. J. 1985. "Strategic Goals, Perceived Uncertainty, and Economic Performance in Volatile Environments," *Academy of Management Journal* (28:3), pp. 548-573.

Bowen, F. E. 2002. "Organizational Slack and Corporate Greening: Broadening the Debate," *British Journal of Management* (13:4), pp. 305-316.

Brownell, P. 1981. "Participation in Budgeting, Locus of Control and Organizational Effectiveness," *Accounting Review*), pp. 844-860.

Calantone, R. J., Cavusgil, S. T., and Zhao, Y. 2002. "Learning Orientation, Firm Innovation Capability, and Firm Performance," *Industrial marketing management* (31:6), pp. 515-524.

Candan, K. S., Li, W.-S., Phan, T., and Zhou, M. 2011. "At the Frontiers of Information and Software as Services," *New Frontiers in Information & Software as Services*), p. 283.

Carpenter, M. A., Geletkanycz, M. A., and Sanders, W. G. 2004. "Upper Echelons Research Revisited: Antecedents, Elements, and Consequences of Top Management Team Composition," *Journal of Management* (30:6), pp. 749-778.

Chen, D. Q., Mocker, M., Preston, D. S., and Teubner, A. 2010. "Information Systems Strategy: Reconceptualization, Measurement, and Implications," *MIS Quarterly* (34:2), pp. 233-A238.

Chen, Y., Wang, Y., Nevo, S., Benitez-Amado, J., and Kou, G. 2015. "It Capabilities and Product Innovation Performance: The Roles of Corporate Entrepreneurship and Competitive Intensity," *Information & Management* (52), pp. 643-657.

Cheng, J. L. C., and Kesner, I. F. 1997. "Organizational Slack and Response to Environmental Shifts: The Impact of Resource Allocation Patterns," *Journal of Management* (23:1), p. 1.

Child, J. 1972. "Organizational Structure, Environment and Performance: The Role of Strategic Choice," *Sociology* (6:1), pp. 1-22.

Choe, J.-m. 2003. "The Effect of Environmental Uncertainty and Strategic Applications of Is on a Firm’s Performance," *Information & Management* (40:4), pp. 257-268.

Cohen, M. D., March, J. G., and Olsen, J. P. 1972. "A Garbage Can Model of Organizational Choice," *Administrative Science Quarterly* (17:1), pp. 1-25.

Crawford, G. 1987. "The Geometric Mean Procedure for Estimating the Scale of a Judgement Matrix," *Mathematical Modelling* (9:3), pp. 327-334.

Cyert, R., and March, J. G. 1992. *A Behavioral Theory of the Firm*, (2nd. ed.). Wiley-Blackwell.

Cyert, R. M., and March, J. G. 1963. "A Behavioral Theory of the Firm," *Englewood Cliffs, NJ* (2).

Damanpour, F. 1991. "Organizational Innovation: A Meta-Analysis of Effects of Determinants and Moderators," *Academy of Management Journal* (34:3), pp. 555-590.

Daniel, F., Lohrke, F. T., Fornaciari, C. J., and Turner, R. A. 2004. "Slack Resources and Firm Performance: A Meta-Analysis," *Journal of Business Research* (57), pp. 565-574.

Day, G. S. 1977. "Diagnosing the Product Portfolio," *The Journal of Marketing*), pp. 29-38.

Devaraj, S., and Kohli, R. 2003. "Performance Impacts of Information Technology: Is Actual Usage the Missing Link?," *Management Science* (49:3), pp. 273-289.

DiMaggio, P. J., and Powell, W. W. 1983. "The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields," *American Sociological Review* (48:2), pp. 147-160.

Dimick, D. E., and Murray, V. V. 1978. "Correlates of Substantive Policy Decisions in Organizations: The Case of Human Resource Management," *Academy of Management Journal* (21:4), pp. 611-623.

Dodgson, M. 1993. "Organizational Learning: A Review of Some Literatures," *Organization Studies* (14:3), pp. 375-394.

Dunk, A. S. 1993. "The Effect of Budget Emphasis and Information Asymmetry on the Relation between Budgetary Participation and Slack," *Accounting Review* (68:2), pp. 400-410.

Economist_Intelligence_Unit. 2015. "Mapping the Cloud Maturity Curve," IBM.

Eisenhardt, K. M. 1989a. "Agency Theory: An Assessment and Review," *Academy of Management Review* (14:1), pp. 57-74.

Eisenhardt, K. M. 1989b. "Building Theories from Case Study Research," *Academy of Management Review* (14:4), pp. 532-550.

El Sawy, O. 2003. "The Is Core Ix: The 3 Faces of Is Identity: Connection, Immersion, and Fusion," *Communications of the Association for Information Systems* (12).

Fama, E. F., and Jensen, M. C. 1983. "Separation of Ownership and Control," *Journal of Law & Economics* (26:2), pp. 301-326.

Farber, D. 2008. "Ibm and the Resurrection of the Mainframe," in: *CNET News*.

Feeny, D. F., Edwards, B. R., and Simpson, K. M. 1992. "Understanding the Ceo/Cio Relationship," *MIS Quarterly* (16:4), pp. 435-448.

Fernhaber, S. A., and Patel, P. C. 2012. "How Do Young Firms Manage Product Portfolio Complexity? The Role of Absorptive Capacity and Ambidexterity How Do Young Firms Manage Product Portfolio Complexity? The Role of Absorptive Capacity and Ambidexterity," *Strategic Management Journal* (33:13), pp. 1516-1539.

Flynn, B. B., Huo, B., and Zhao, X. 2010. "The Impact of Supply Chain Integration on Performance: A Contingency and Configuration Approach," *Journal of Operations Management* (28:1), pp. 58-71.

Freel, M. S. 2005. "Perceived Environmental Uncertainty and Innovation in Small Firms," *Small business economics* (25:1), pp. 49-64.

Gardner, H. J., and Martin, M. 2007. "Analyzing Ordinal Scales in Studies of Virtual Environments: Likert or Lump It!," *Presence* (16:4), pp. 439-446.

Garrison, G., Kim, S., and Wakefield, R. L. 2012. "Success Factors for Deploying Cloud Computing," *Communications of the ACM* (55:9), pp. 62-68.

Gerring, J. 2006. *Case Study Research: Principles and Practices*. Cambridge University Press.

Gibson, C. B., and Birkinshaw, J. 2004. "The Antecedents, Consequences, and Mediating Role of Organizational Ambidexterity," *Academy of Management Journal* (47:2), pp. 209-226.

Golden, B. 2009. "Capex Vs Opex: Most Miss Point About Cloud Economics," in: *IT World*.

Gregory, R. W., Keil, M., Muntermann, J., and Mähring, M. 2015. "Paradoxes and the Nature of Ambidexterity in It Transformation Programs," *Information Systems Research* (26:1), pp. 57-80.

Hambrick, D. C., and Snow, C. C. 1977. "A Contextual Model of Strategic Decision Making in Organizations," R.L. Taylor, J.J. O'Connell, R.A. Zawaki and D.D. Warrick (eds.): Academy of Management, pp. 109-112.

Han, Y. 2011a. "Cloud Computing: Case Studies and Total Cost of Ownership," *Information technology and libraries* (30:4), pp. 198-206.

Han, Y. 2011b. "Cloud Computing: Case Studies and Total Costs of Ownership," *Information Technology & Libraries* (30:4), pp. 198-206.

Hansen, G. S., and Wernerfelt, B. 1989. "Determinants of Firm Performance: The Relative Importance of Economic and Organizational Factors," *Strategic Management Journal* (10:5), pp. 399-411.

Harrison, J. S., O'Neill, H. M., and Hoskisson, R. E. 2000. "Acquisition Strategy and Target Resistance: A Theory of Countervailing Effects of Pre-Merger Bidding and Post Merger Integration," in *Advances in Mergers and Acquisitions*. Emerald Group Publishing Limited, pp. 157-182.

Hayman, J. 2013. "It 2014: Positive Shift in Expected Spending; Leaders Optimistic in Ability to Support Business Objectives; Core Skills More Critical Than Management." Hanover Maryland: TEKsystems.

He, Z.-L., and Wong, P.-K. 2004. "Exploration Vs. Exploitation: An Empirical Test of the Ambidexterity Hypothesis," *Organization Science* (15:4), pp. 481-494.

Jalao, E. R. L., Shunk, D. L., and Wu, T. 2012. "Life Cycle Costs and the Analytic Network Process for Software-as-a-Service Migration," *IAENG International Journal of Computer Science* (39:3), pp. 269-275.

Jansen, J. J., Van Den Bosch, F. A., and Volberda, H. W. 2006. "Exploratory Innovation, Exploitative Innovation, and Performance: Effects of Organizational Antecedents and Environmental Moderators," *Management Science* (52:11), pp. 1661-1674.

Jaworski, B. J., and Kohli, A. K. 1993. "Market Orientation: Antecedents and Consequences," *Journal of Marketing* (57:3), p. 53.

Jensen, M. C., and Meckling, W. H. 1976. "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure," *Journal of financial economics* (3:4), pp. 305-360.

Jick, T. D. 1979. "Mixing Qualitative and Quantitative Methods: Triangulation in Action," *Administrative Science Quarterly*), pp. 602-611.

Jones, T. O., and Sasser Jr, W. E. 1995. "Why Satisfied Customers Defect," *Harvard Business Review* (73:6), pp. 88-91.

Kakabadse, A., and Kakabadse, N. 2005. "Outsourcing: Current and Future Trends," *Thunderbird International Business Review* (47:2), pp. 183-204.

Kanter, R. 1986. "Supporting Innovation and Venture Development in Established Companies," *Journal of Business Venturing* (1:1), pp. 47-60.

Kaplan, B., and Duchon, D. 1988. "Combining Qualitative and Quantitative Methods in Information Systems Research: A Case Study," *MIS Quarterly*), pp. 571-586.

Katila, R., and Ahuja, G. 2002. "Something Old, Something New: A Longitudinal Study of Search Behavior and New Product Introduction," *Academy of Management Journal* (45:6), pp. 1183-1194.

Kearns, G. S., and Lederer, A. L. 2003. "A Resource ‐ Based View of Strategic It Alignment: How Knowledge Sharing Creates Competitive Advantage," *Decision Sciences* (34:1), pp. 1-29.

Kogut, B., and Zander, U. 1992. "Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology," *Organization Science* (3:3), pp. 383-397.

Krippendorff, K. 2012. *Content Analysis: An Introduction to Its Methodology*. Sage.

Lacity, M. C., and Willcocks, L. P. 1998. "An Empirical Investigation of Information Technology Sourcing Practices: Lessons from Experience," *MIS Quarterly* (22:3), pp. 363-408.

Lant, T. K. 1986. "Modeling Organizational Slack: An Empirical Investigation," in: *Management*. Stanford, CA: Stanford University.

Latham, S. F., and Braun, M. R. 2008. "The Performance Implications of Financial Slack During Economic Recession and Recovery: Observations from the Software Industry (2001-2003)," *Journal of Managerial Issues* (20:1), pp. 30-50.

Leeuwen, L. K. G. V. 2001. "Linking Innovation and Firm Performance: A New Approach," *International Journal of the Economics of Business* (8:3), pp. 343-364.

Leonhardt, D., Haffke, I., Kranz, J., and Benlian, A. 2017. "Reinventing the It Function: The Role of It Agility and It Ambidexterity in Supporting Digital Business Transformation,").

Lewin, A. Y., and Wolf, C. 1973. "The Theory of Organizational Slack: A Critical Review," *Proceedings of the ... international meeting of the Institute of Management Sciences* (20:2), pp. 648-655.

Litschert, R. J., and Bonham, T. W. 1978. "A Conceptual Model of Strategy Formation," *Academy of Management Review* (3:2), pp. 211-219.

Lombard, M., Snyder-Duch, J., and Bracken, C. C. 2002. "Content Analysis in Mass Communication," *Human communication research* (28:4), pp. 587-604.

Lu, Y., and Ramamurthy, K. 2004. "Does Information Technology Always Lead to Better Firm Performance? The Role of Environmental Dynamism," *ICIS 2004 Proceedings*), p. 20.

Lubatkin, M. H., Simsek, Z., Ling, Y., and Veiga, J. F. 2006. "Ambidexterity and Performance in Small-to Medium-Sized Firms: The Pivotal Role of Top Management Team Behavioral Integration," *Journal of Management* (32:5), pp. 646-672.

Lundquist, E. 2012. "How It's Perceived by Business," InformationWeek.

March, J. G. 1979. "Interview," in: *Stanford GSB*. California: Stanford University, pp. 16-19.

March, J. G. 1991. "Exploration and Exploitation in Organizational Learning," *Organization Science* (2:1), pp. 71-87.

March, J. G., and Olsen, J. P. 1976. *Ambiguity and Choice in Organizations / by James G. March and Johan P. Olsen, with Contributions by Søren Christensen ... [Et Al]*. Bergen : Universitetsforlaget, c1976.

Marcoulides, G. A., Chin, W. W., and Saunders, C. 2009. "A Critical Look at Partial Least Squares Modeling," *MIS Quarterly* (33:1), pp. 171-175.

Markus, M. L. 1983. "Power, Politics, and Mis Implementation," *Communications of the ACM* (26:6), pp. 430-444.

Megna, P., and Mueller, D. C. 1991. "Profit Rates and Intangible Capital," *The review of economics and statistics*), pp. 632-642.

Melville, N., Kraemer, K., and Gurbaxani, V. 2004a. "Information Technology and Organizational Performance: An Integrative Model of It Business Value," *MIS Quarterly* (28:2), pp. 283-322.

Melville, N., Kraemer, K., and Gurbaxani, V. 2004b. "Review: Information Technology and Organizational Performance: An Integrative Model of It Business Value," *MIS Quarterly* (28:2), pp. 283-322.

Mithas, S., Ramasubbu, N., and Sambamurthy, V. 2011. "How Information Management Capability Influences Firm Performance," *MIS Quarterly* (35:1), pp. 137-A115.

Mithas, S., and Rust, R. T. 2016. "How Information Technology Strategy and Investments Influence Firm Performance: Conjecture and Empirical Evidence," *MIS Quarterly* (40:1), pp. 223-245.

Mithas, S., Tafti, A., and Mitchell, W. 2013. "How a Firm's Competitive Environment and Digital Strategic Posture Influence Digital Business Strategy," *MIS Quarterly* (37:2), pp. 511-536.

Murphy, C. 2012. "2012 State of It Staffing," InformationWeek.

Myers, M. D., and Newman, M. 2007. "The Qualitative Interview in Is Research: Examining the Craft," *Information and organization* (17:1), pp. 2-26.

Neuendorf, K. A. 2002. *The Content Analysis Guidebook*. Sage.

Nevo, D., Benbasat, I., and Wand, Y. 2012. "Understanding Technology Support for Organizational Transactive Memory: Requirements, Application, and Customization," *Journal of Management Information Systems* (28:4), pp. 69-98.

Newkirk, H. E., and Lederer, A. L. 2006. "The Effectiveness of Strategic Information Systems Planning under Environmental Uncertainty," *Information & Management* (43:4), pp. 481-501.

Nohria, N., and Gulati, R. 1996. "Is Slack Good or Bad for Innovation?," *Academy of Management Journal* (39:5), pp. 1245-1264.

Nonaka, I. 1994. "A Dynamic Theory of Organizational Knowledge Creation," *Organization Science* (5:1), pp. 14-37.

O'Reilly, C. A., and Tushman, M. L. 2013a. "Organizational Ambidexterity: Past, Present, and Future," *Academy of Management Perspectives* (27:4), pp. 324-338.

O'Reilly, C. A., and Tushman, M. L. 2013b. "Organizational Ambidexterity: Past, Present, and Future," *The Academy of Management Perspectives* (27:4), pp. 324-338.

Olsson, H. H., Ó Conchúir, E., Ågerfalk, P. J., and Fitzgerald, B. 2008. "Two-Stage Offshoring: An Investigation of the Irish Bridge," *MIS Quarterly* (32:2), pp. 257-279.

Onsi, M. 1973. "Factor Analysis of Behavioral Variables Affecting Budgetary Slack," *Accounting Review* (48:3), pp. 535-548.

Özsomer, A., Calantone, R. J., and Di Bonetto, A. 1997. "What Makes Firms More Innovative? A Look at Organizational and Environmental Factors," *Journal of Business & Industrial Marketing* (12:6), pp. 400-416.

Palmer, T. B., and Wiseman, R. M. 1999. "Decoupling Risk Taking from Income Stream Uncertainty: A Holistic Model of Risk," *Strategic Management Journal* (20:11), pp. 1037-1062.

Pawlowski, S. D., and Robey, D. 2004. "Bridging User Organizations: Knowledge Brokering and the Work of Information Technology Professionals," *MIS Quarterly* (28:4), pp. 645-672.

Perlow, L. A., Okhuysen, G. A., and Repenning, N. P. 2002. "The Speed Trap: Exploring the Relationship between Decision Making and Temporal Context," *Academy of Management Journal* (45:5), pp. 931-955.

Pfeffer, J., and Salancik, G. R. 1978. *The External Control of Organizations : A Resource Dependence Perspective / Jeffrey Pfeffer, Gerald R. Salancik*. New York : Harper & Row, c1978.

Piccoli, G., and Ives, B. 2005. "It-Dependent Strategic Initiatives and Sustained Competitive Advantage: A Review and Synthesis of the Literature," *MIS Quarterly* (29:4), pp. 747-776.

Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., and Podsakoff, N. P. 2003. "Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies," *Journal of Applied Psychology* (88:5), pp. 879-903.

Porter, M. E. 1980. *Competitive Strategy : Techniques for Analyzing Industries and Competitors / Michael E. Porter*. New York : Free Press, c1980.

Porter, M. E. 2008. "The Five Competitive Forces That Shape Strategy," *Harvard Business Review* (86:1), pp. 78-93.

Porter, M. E., and Millar, V. E. 1985. "How Information Gives You Competitive Advantage," *Harvard Business Review* (63:4), pp. 149-160.

Powell, T. C., and Dent-Micallef, A. 1997. "Information Technology as Competitive Advantage: The Role of Human, Business, and Technology Resources," *Strategic Management Journal* (18:5), pp. 375-405.

Pyburn, P. J. 1983. "Linking the Mis Plan with Corporate Strategy: An Exploratory Study," *MIS Quarterly* (7:2), pp. 1-14.

Raisch, S., and Birkinshaw, J. 2008. "Organizational Ambidexterity: Antecedents, Outcomes, and Moderators," *Journal of Management* (34:3), pp. 375-409.

Reitzes, B., Lenschow, R., Peller, D., Gardiner, A., Essaegh, Y., Vos, G., and Yang, K. 2012. "Global Technology Outlook: A Look at the Three Columns of Tech Investing," Barclays Capital.

Russell, C. J., and Russell, R. D. 1992. "An Examination of the Effects of Organizational Norms, Organizational Structure, and Environmental Uncertainty on Entrepreneurial Strategy," *Journal of Management* (18:4), p. 639.

Sabherwal, R., and Jeyaraj, A. 2015. "Information Technology Impacts on Firm Performance: An Extension of Kohli and Devaraj (2003)," *MIS Quarterly* (39:4), pp. 809-836.

Schmalensee, R. 1978. "A Model of Advertising and Product Quality," *The Journal of Political Economy*), pp. 485-503.

Schoemaker, P. J. 1990. "Strategy, Complexity, and Economic Rent," *Management Science* (36:10), pp. 1178-1192.

Sharfman, M. P., Wolf, G., Chase, R. B., and Tansik, D. A. 1988. "Antecedents of Organizational Slack," *Academy of Management Review* (13:4), pp. 601-614.

Sherif, K., and Menon, N. M. 2004. "Managing Technology and Administration Innovations: Four Case Studies on Software Reuse," *Journal of the Association for Information Systems* (5:7), p. 2.

Shim, J., Shin, Y. B., and Nottingham, L. 2002. "Retailer Web Site Influence on Customer Shopping: Exploratory Study on Key Factors of Customer Satisfaction," *Journal of the Association for Information Systems* (3:1), p. 3.

Smirlock, M., Gilligan, T., and Marshall, W. 1984. "Tobin's Q and the Structure-Performance Relationship," *The American Economic Review*), pp. 1051-1060.

Sørensen, J. B. 2002. "The Strength of Corporate Culture and the Reliability of Firm Performance," *Administrative Science Quarterly* (47:1), pp. 70-91.

Souder, W. E., Sherman, J. D., and Davies ‐ Cooper, R. 1998. "Environmental Uncertainty, Organizational Integration, and New Product Development Effectiveness: A Test of Contingency Theory," *Journal of Product Innovation Management* (15:6), pp. 520-533.

Spender, J. C. 1996. "Making Knowledge the Basis of a Dynamic Theory of the Firm," *Strategic Management Journal* (17), pp. 45-62.

Strong, D. M., and Volkoff, O. 2010. "Understanding Organization—Enterprise System Fit: A Path to Theorizing the Information Technology Artifact," *MIS Quarterly* (34:4), pp. 731-756.

Stuart, T. E. 2000. "Interorganizational Alliances and the Performance of Firms: A Study of Growth and Innovation Rates in a High-Technology Industry," *Strategic Management Journal* (21:8), pp. 791-811.

Subramani, M. 2004. "How Do Suppliers Benefit from Information Technology Use in Supply Chain Relationships?," *MIS Quarterly*), pp. 45-73.

Susarla, A., Barua, A., and Whinston, A. B. 2009. "A Transaction Cost Perspective of the "Software as a Service" Business Model," *Journal of Management Information Systems* (26:2), pp. 205-240.

Tan, J., and Peng, M. W. 2003. "Organizational Slack and Firm Performance During Economic Transitions: Two Studies from an Emerging Economy," *Strategic Management Journal* (24:13), pp. 1249-1263.

Tatikonda, M. V., and Rosenthal, S. R. 2000. "Technology Novelty, Project Complexity, and Product Development Project Execution Success: A Deeper Look at Task Uncertainty in Product Innovation," *Engineering Management, IEEE Transactions on* (47:1), pp. 74-87.

Thompson, J. D. 2003. *Organizations in Action : Social Science Bases of Administrative Theory / James D. Thompson ; with a New Preface by Mayer N. Zald and a New Introduction by W. Richard Scott*. New Brunswick, NJ : Transaction Publishers, c2003.

Tushman, M. L., and O'Reilly III, C. A. 1996. "Ambidextrous Organizations: Managing Evolutionary and Revolutionary Change," *California Management Review* (38:4).

Vagadia, B. 2012. *Strategic Outsourcing [Electronic Resource] : The Alchemy to Business Transformation in a Globally Converged World / Bharat Vagadia*. Heidelberg ; New York : Springer, 2012.

Venkatraman, N., Lee, C.-H., and Iyer, B. 2007. "Strategic Ambidexterity and Sales Growth: A Longitudinal Test in the Software Sector," *Unpublished Manuscript (earlier version presented at the Academy of Management Meetings, 2005).*

Weigelt, C., and Sarkar, M. B. 2012. "Performance Implications of Outsourcing for Technological Innovations: Managing the Efficiency and Adaptability Trade-Off," *Strategic Management Journal* (33:2), pp. 189-216.

Wolcott, R. C., and Lippitz, M. J. 2007. "The Four Models of Corporate Entrepreneurship," *MIT Sloan Management Review* (49:1), p. 75.

Xin, M., and Levina, N. 2008. "Software-as-a-Service Model: Elaborating Client-Side Adoption Factors," *Proceedings of the 29th International Conference on Information Systems, R. Boland, M. Limayem, B. Pentland,(eds), Paris, France*.

Xue, L., Ray, G., and Sambamurthy, V. 2012. "Efficiency or Innovation: How Do Industry Environments Moderate the Effects of Firms' It Asset Portfolios?," *MIS Quarterly* (36:2), pp. 509-528.

Yin, R. K. 2014. *Case Study Research: Design and Methods*. Sage publications.

Zander, U., and Kogut, B. 1995. "Knowledge and the Speed of the Transfer and Imitation of Organizational Capabilities: An Empirical Test," *Organization Science* (6:1), pp. 76-92.

Appendix A

Individual Case Detail and Analyses

Case Alloy: Alloy was a computer systems design, software development, and information systems integration firm that delivered products and services that aid in the development of certain digital business strategies to a variety of industries. This firm was experiencing high growth of 20-25% per annum, which may in part be an indication of the adoption rate of digital business strategies across a wide spectrum of industry sectors. Alloy's primary digital business strategy foci included pervasive computing in the form of mobility (wireless communications) and bring-your-own-device (BYOD) for employees, big data as a set of productized tools for sales to customers, and cloud computing for both internal use and product/services sales.

Alloy has implemented the SaaS variant of cloud computing to perform business process execution and management for accounting, finance, marketing, sales, customer service, production/operations, and IT. The CIO's involvement in the SaaS contracting efforts was limited to financial analysis of the contracts. Their first use of SaaS occurred 11 years ago, and their current SaaS expenditures accounted for roughly 10% of the IT budget. Almost everyone in the company, in both front office and back office positions, use some form of SaaS to perform standard business processes. Ranking the SaaS adoption profile was determined as follows:

1) Functional department use – HIGH
2) Age of first deployment – HIGH
3) Budgetary commitment – MODERATE
4) Value chain penetration - HIGH
5) Employee work requirement – HIGH
6) Total SaaS adoption profile – HIGH

The primary reasons given for adopting SaaS were to support cost reductions and reduce time to market for new feature implementation, consistent with the predominant criteria identified by Susarla et al. (2009). An underlying motivation may have been to support rapid firm growth as SaaS could be conceptualized as a means to build potential slack in the IT operation because new users can be added piecemeal without incurring capital expense and/or increasing the size of routine maintenance and support staff.

Because cost reduction was listed as a primary reason to adopt SaaS, and that cost reduction did in fact occur, financial slack in continuing operations, or the IT Efficiency construct, was created as the result of said adoption. This level of financial slack was interpreted and coded as MODERATE. However, the creation, deployment, and consumption of this slack was dependent on whether the SaaS was replacing an existing application (the replacement scenario) or implementing new functionality into the business process model (the greenfield scenario). In the case of replacement scenarios, which was the dominant type, actual monetary slack was returned to the organization, and in the case of greenfield scenarios, the IT budget was increased to accommodate the new functionality. Only in replacement scenarios was financial or monetary slack produced; greenfield scenarios resulted in budgetary increases to accommodate greater allocations to SaaS. As such, the deployment of monetary slack was interpreted and coded as NONE with regard to remaining within IT operations. Regardless of the monetary slack created as a result of SaaS adoption, the IT budget had sufficient buffer such that losing 10% of the budget without warning would not impact IT operations, either continuing or innovative project work, for two years in spite of a 20%+ annual firm growth rate.

For SaaS replacement scenario cases, operational slack in the form of excess computing resources was produced within the IT Efficiency construct, a level interpreted and coded as

MODERATE to HIGH due in part to the fact that the company had the same compute-side resource footprint in spite of 2X growth. This tangible slack in the form of computers and networking equipment was transferred to the IT Innovation construct and utilized to a degree such that a loss of 10% of computing resources would have an immediate impact on IT Innovation projects, a level interpreted and coded as HIGH. This series of events represents the creation, deployment, and utilization of one form of slack within a single functional department. When considering that Alloy was in the Information Technology industry, it is feasible to assert that the transfer of operational slack from IT Efficiency to IT Innovation presents less friction than that which may be found in non-IT industry sectors.

The adoption of SaaS also impacted IT human resources, allowing Alloy to reduce routine maintenance and support personnel by a level interpreted and coded as MODERATE from within the IT Efficiency construct. Those personnel selected for retraining were transferred from IT Efficiency to IT Innovation, thus resulting in a general increase in IT human resources engaged in creative project-type work. This form of slack was deployed and utilized to a greater degree than that of computing resources, such that a loss of 10% of their time would seriously impact the IT department’s ability to meet schedules for deploying revenue-generating products and services. For that reason, the consumption of human resource slack was interpreted and coded as HIGH.

One additional form of slack produced by SaaS adoption is that of managerial time. In the case of Alloy, the production level of managerial time slack from within the IT Efficiency construct was interpreted and coded as HIGH, concomitant with the SaaS adoption level itself. Regardless of replacement or greenfield scenarios, managerial time was transferred from IT

Efficiency to IT Innovation and utilized to a degree interpreted and coded as HIGH, in part due to the serious impact envisioned should 10% of their time be unavailable.

Converting the interpreted and coded data to numerical ranks, SaaS Adoption is measured on a five-level scale ranging from one to three in half-point increments. Individual forms of deployed slack that were derived from coded interview responses related to the transfer amounts of SaaS-induced slack from IT Efficiency to IT Innovation. As with SaaS Adoption, these slack transfer components were measured on a five-point scale ranging from one to five in half-point increments. Table B1 collates numerical equivalents of the interpreted and coded data from Case Alloy.

Table B1: Case Alloy interpreted and coded qualitative measures

SaaS Adoption	FinSlack Deployed	OpSlack Deployed	HRSlack Deployed	TimeSlack Deployed
High (3.0)	None (0.0)	Moderate-High (2.5)	Moderate (2.0)	High (3.0)

The remaining constructs of the research model – IT Efficiency, IT Innovation, IT Performance, Firm Performance, Environmental Dynamism, and Control Variables – were assessed using the reliable and valid measures previously specified. However, because case method research does not typically provide sufficient sampling to conduct a standard causal analysis (Abbott 2004; Benbasat et al. 1987; Eisenhardt 1989b; Yin 2014), an index representing a relative value for each construct was computed as the geometric mean of the construct's indicators (Crawford 1987; Jalao et al. 2012). For the measurement of IT Ambidexterity, the absolute value of the geometric mean of IT Efficiency minus the geometric mean of IT Innovation was computed in a manner similar to that proposed by He and Wong (2004). This ordering of equation components is also consistent with the established focus of IT supporting business strategy through information and process efficiency (Mithas et al. 2011).

For the measurement of Environmental Dynamism, the geometric means of turbulence, competitive intensity, and technological intensity were added sequentially and also examined individually. This collection of quantitative measures for each case, from Alloy through Gluon, will be examined further in cross-case and multi-case analyses.

Case Boson: Boson was a firm engaged in providing business software and support services to a limited number of industries across global markets so that those customer firms can execute traditional business processes. These products were delivered as either licensed software to be hosted by the customer or SaaS variants supported in Boson's data center operations. Boson was experiencing low growth of 2-5% per annum, which may have in part indicated the mature status of the industries to which it supplied software and services. Their digital business strategy foci included pervasive computing (mobility and BYOD) for employee use, integrated but modular global supply chains for internal use, and cloud computing for both internal use and as a suite of revenue-generating products and services.

Boson had implemented the SaaS variant of cloud computing to perform business process execution and management for sales, customer service, production/operations (testing only), and human resources. The CIO's involvement in the SaaS contracting efforts was limited to governance oversight and contract approval. Their first use of SaaS occurred five years ago, and their current SaaS expenditures accounted for approximately 1% of the IT budget. Roughly 10% of the employees, in both front office and back office positions, used some form of SaaS to perform standard business processes. Ranking the SaaS adoption profile was determined as follows:

1) Functional department use – MODERATE

2) Age of first deployment – MODERATE

3) Budgetary commitment – LOW

4) Value chain penetration - MODERATE

5) Employee work requirement – LOW

6) Total SaaS adoption profile – LOW to MODERATE

The primary reasons given for adopting SaaS were to support cost reductions and simplify operations, consistent with the predominant criteria identified by Susarla et al. (2009).

Because cost reduction was listed as a primary reason to adopt SaaS, and that cost reduction did in fact occur, financial slack in continuing operations, or the IT Efficiency construct, was created as the result of said adoption. This level of financial slack was interpreted and coded as LOW. As with Case Alloy, the creation, deployment, and consumption of this slack was dependent on whether the SaaS was replacing an existing application (the replacement scenario) or implementing new functionality into the business process model (the greenfield scenario). In the case of replacement scenarios, which was the dominant type, actual monetary slack was returned to the organization, and in the case of greenfield scenarios, the IT budget was increased to accommodate the new functionality. Only in replacement scenarios was financial or monetary slack produced; greenfield scenarios resulted in budgetary increases to accommodate greater allocations to SaaS. As such, the deployment of monetary slack was interpreted and coded as LOW with regard to remaining within IT operations. The IT budget had a minimal buffer such that losing 10% of the budget without warning would have an immediate and significant impact on IT operations, on both continuing operations and innovative project work.

For SaaS replacement scenario cases, operational slack in the form of excess computing resources was produced within the IT Efficiency construct, a level interpreted and coded as MODERATE. This tangible slack in the form of computers and networking equipment was either transferred to the IT Innovation construct or maintained within IT Efficiency, and utilized to a degree such that a loss of 10% of computing resources would have had a minimal impact on IT operations, both for continuing and project work; this level of slack consumption was interpreted and coded as LOW. The events describing operational slack represented the creation, deployment, and utilization of one form of slack within a single functional department. When considering that Boson is in the Information Technology industry, as with Case Alloy, it is feasible to assert that the transfer of operational slack from IT Efficiency to IT Innovation presents less friction than that which may be found in non-IT industry sectors.

The adoption of SaaS also impacted IT human resources, allowing Boson to reduce routine maintenance and support personnel by a level interpreted and coded as MODERATE from within the IT Efficiency construct. Those personnel selected for retraining were transferred from IT Efficiency to IT Innovation, and thus resulted in a general increase in IT human resources engaged in innovative project-type work. This form of slack was deployed and utilized to a greater degree than that of computing resources such that a loss of 10% of their time would have seriously impacted the IT department's ability to meet schedules for deploying revenue-generating products and services. For that reason, the consumption of human resource slack was interpreted and coded as HIGH.

One additional form of slack produced by SaaS adoption is that of managerial time. In the case of Boson, the production level of managerial time slack from within the IT Efficiency construct was interpreted and coded as MODERATE. Regardless of replacement or greenfield scenarios, managerial time was transferred from IT Efficiency to IT Innovation and utilized to a degree interpreted and coded as HIGH, in part due to the serious impact on project completion envisioned should 10% of their time be unavailable. Refer to Table B2 for a tabulation of Case Boson's interpreted and coded measures.

Table B2: Case Boson interpreted and coded qualitative measures

SaaS Adoption	FinSlack Deployed	OpSlack Deployed	HRSlack Deployed	TimeSlack Deployed
Low-Moderate (1.5)	None (0.0)	Low (1.0)	Moderate (2.0)	Moderate (2.0)

Case Covalent: Covalent was a firm engaged in the manufacture and distribution of consumer food and beverage products in over 100 geographic markets around the world through both wholesale and retail channels. Covalent was currently experiencing low growth of less than 0% per annum, which may in part indicate the increasingly competitive nature of their markets combined with low perceived consumer switching costs (Porter 2008) for its wide range of food and beverage products. In spite of these deleterious forces, they held the #1 or #2 position in each of their product categories across all markets. Their digital business strategy foci included pervasive computing in the form of wireless communications to support a mobile workforce, big data for the internal analysis of consumer dynamics, and cloud computing as a means to leverage application functionality and cost reduction.

Covalent had implemented the SaaS variant of cloud computing to perform business process execution and management for portions of the workload in accounting, marketing, finance, and IT. SaaS was dominant in sales and customer service and minimal in production/operations. The key limiting factor in the proliferation of SaaS within Covalent was their enterprise resource planning software (ERP), which was licensed but hosted in an

Infrastructure-as-a-Service (IaaS) cloud computing model. While their vendor offered an SaaS variant, they encountered numerous hurdles in moving enterprise licensed software to a per-seat model. The CIO's involvement in the SaaS contracting efforts included financial, governance, and functional oversight, depending on the contract. Their first use of IaaS was initiated five years ago while the first SaaS application went live three years ago, and their current SaaS expenditures accounted for approximately 20% of the IT budget. Employees in both front office and back office positions used some form of SaaS to perform at least a portion of their standard business processes. Beyond the use of SaaS, Covalent used cloud computing (IaaS and SaaS) for 70% of all IT-delivered hardware and/or software. Ranking the combined IaaS + SaaS adoption profile was determined as follows:

1) Functional department use – MODERATE to HIGH
2) Age of first deployment –MODERATE
3) Budgetary commitment – HIGH
4) Value chain penetration – MODERATE to HIGH
5) Employee work requirement – HIGH
6) Total SaaS adoption profile – HIGH

The primary reasons given for adopting SaaS were to achieve faster time to market, maintenance and upgrade support, lower entry cost, and increased functionality. However, the IT operation had reduced costs by more than 20% per annum, which indicates that cost reduction was a major factor in their decision making.

Because cost reduction was an implied, though important, reason to fuel cloud computing adoption, and that cost reduction did in fact occur, financial slack in continuing operations, or the IT Efficiency construct, was created as a result. This level of financial slack was interpreted and coded as MODERATE. Unlike Case Alloy, the creation, deployment, and consumption of this slack was not dependent on the presence of replacement or greenfield scenarios. In all cases, monetary slack was returned to the organization as a component of IT cost reduction efforts. As such, the deployment of monetary slack was interpreted and coded as NONE with regard to remaining within IT. Because of dramatic cost reductions, the IT budget had a large buffer such that losing 10% of the budget without warning would have had no impact on IT functionality, for both continuing operations and innovative project work.

As for operational slack, Covalent was unique in that they operated no data centers and they owned no computing resources as a direct result of cloud computing in both IaaS and SaaS variants. As such, the level of operational slack created due to SaaS adoption was interpreted and coded as NONE. This was related to the fact that IaaS predated SaaS adoption by two years; most operational resources were already deployed through cloud vendors before the first SaaS application went live. The adoption of IaaS resulted in significant reductions in computing resources, an amount interpreted and coded as HIGH, which were then idled and salvaged. While this may appear to constrain operational slack, in fact it does just the opposite. Instead of creating operational slack in the form of immediately available tangible computing resources, the cloud computing contracts offer an almost unlimited potential in operational slack. Initiating a contractual expansion creates additional computing capacity without any capital investment or real estate consumption (Han 2011a).

For SaaS in all scenarios, no immediate operational slack in the form of excess computing resources was produced within the IT Efficiency construct, a level interpreted and coded as NONE. As such, there was no transfer of operational resources from IT Efficiency to IT Innovation as a result of SaaS adoption. However, a HIGH amount of potential slack was created by IaaS adoption, and said slack is available through contractual means. It has been applied to either IT Efficiency or IT Innovation at will, and the amount of time to convert this potential slack to available slack (Lant 1986) for consumption by continuing operations or creative project work was perceived to be low. The events describing operational slack represent the creation, annihilation, reintroduction, and consumption of one form of slack within a single functional department. While no internal transfer of resources occurred from IT Efficiency to IT Innovation, cloud computing resources are distributed between them.

The adoption of SaaS also impacted IT human resources, allowing Covalent to reduce routine maintenance and support personnel by a level interpreted and coded as HIGH from within the IT Efficiency construct. Those personnel selected for retraining were transferred from IT Efficiency to IT Innovation, thus resulting in a general increase in IT human resources engaged in innovative project-type work specifically to improve company performance. The remainder of these human resources was divested from the firm as a component of IT cost reduction efforts. This form of slack was deployed and utilized such that a loss of 10% of non-managerial time would force the reduction or elimination of all innovative project work. For that reason, the consumption of human resource slack was interpreted and coded as HIGH.

One final form of slack studied by this research is that of managerial time. Through high adoption levels of IaaS and SaaS cloud computing combined, Covalent achieved a level of managerial time slack from within the IT Efficiency construct that was interpreted and coded as HIGH. Regardless of replacement or greenfield scenarios, managerial time was transferred from IT Efficiency to IT Innovation and utilized to a degree interpreted and coded as HIGH, in part due to the serious impact on project completion envisioned should 10% of their time be unavailable. According to the key informant, managerial time is now the dominant form of human resource time within the IT function. Instead of funding in-house application development work focused on innovative projects, Covalent outsourced software programming while keeping IT knowledge internally through managerial resources. Knowledge in the form of IT managers was distributed throughout the firm, which has either intentionally or unintentionally created the potential for an IT-centered transactive memory system (e.g., Nevo et al. 2012). Refer to Table B3 for Case Covalent's interpreted and coded qualitative data converted to its numerical equivalents.

Table B3: Case Covalent interpreted and coded qualitative measures

SaaS Adoption	FinSlack Deployed	OpSlack Deployed	HRSlack Deployed	TimeSlack Deployed
High (3.0)	None (0.0)	None (0.0)	High (3.0)	High (3.0)

Case Dyne: Dyne manufactured and distributed a narrow range of products in the home furnishings subsector of the consumer goods industry in more than 70 countries through both wholesale, third-party retail, and company-owned retail channels. Dyne was experiencing revenue growth of between five and eight percent per annum in spite of competitive pressures, perhaps due to a strong brand presence. Their digital business strategy foci included pervasive computing in the form of wireless communications and bring-your-own-device to support a mobile workforce, a fully integrated global supply chain, and cloud computing as a means to leverage application functionality and cost reduction.

Dyne had applied the SaaS variant of cloud computing to perform business process execution and management for portions of accounting and finance tasks, but SaaS is a key enabler in Outbound Logistics, allowing one product line to achieve a three-day cycle from web-enabled order management to completed customer delivery. This Just-In-Time (JIT) process flow demonstrated the internal use of SaaS, when integrated with a web interface and a licensed enterprise software system, to achieve a fully integrated global supply chain that connected numerous manufacturing plants and a transportation network of over 1,000 trucks. The implementation of the enterprise software was hosted in an internal data center, and while the vendor offered an SaaS option, there were no plans to transfer from a traditional licensed to a per-seat model. The CIO's involvement in the SaaS contracting efforts included financial, governance, and functional oversight. The first SaaS application went live five years ago, and their current SaaS expenditures accounted for approximately 10% of the IT budget. Employees solely in back office positions use some form of SaaS to perform at least a portion of their standard business processes, and five percent of the total workforce use SaaS for all business process execution. Ranking the SaaS adoption profile was determined as follows:

1) Functional department use – LOW
2) Age of first deployment –MODERATE
3) Budgetary commitment – MODERATE
4) Value chain penetration – LOW to MODERATE
5) Employee work requirement – LOW
6) Total SaaS adoption profile – LOW to MODERATE

The primary reasons given for adopting SaaS were to achieve the functionality that enabled JIT manufacturing processes followed by software upgrades, maintenance, and support. However, the IT operation had reduced costs by roughly 12% per annum as a result of productivity improvements. In addition, the in-house development of the Outbound Logistics software would have consumed the entire IT budget for one year, which indicated that cost reduction was an understated yet important factor in their SaaS adoption decision making.

Because development and operational cost reduction was a factor in SaaS adoption, and that cost reduction did in fact occur, financial slack in continuing operations, or the IT Efficiency construct, was created as a result. This level of financial slack, which was created through productivity improvement, was interpreted and coded as MODERATE. However, as a greenfield scenario, this slack represents a reduction in the cost to deploy a global supply chain, a new aspect of company operations. As such, the deployment of monetary slack was interpreted and coded as NONE with regard to remaining within IT. Because of budgetary reductions totaling more than 44% over a five year period in spite of a 40% increase in firm headcount, the IT budget had a large buffer. Losing 10% of the budget without warning would have had no impact on IT functionality, for both continuing operations and innovative project work.

As for operational slack, because the dominant use of SaaS was a greenfield scenario, the level of operational slack created in the form of computing and networking resources was interpreted and coded as NONE. As such, there was no transfer of operational resources from IT Efficiency to IT Innovation as a result of SaaS adoption. With regard to the presence of existing operational slack, the loss of 10% of computing infrastructure would have severely impacted IT operations, especially when considering that the internal data center was growing by 15% per year. Tangible computing resources were considered an important investment toward the goal of continuous productivity improvement.

Because of the greenfield scenario in Outbound Logistics, the adoption of SaaS did not directly impact IT human resource slack, a level interpreted and coded as NONE. While the pursuit of a digital business strategy had increased the number of IT personnel working on innovative projects, the number of routine maintenance and support personnel had not changed as a result of SaaS adoption. According to the interpreted and coded responses, there was no creation of human resource slack but there was a LOW transfer of personnel from the IT Efficiency construct to IT Innovation due to productivity improvements partially enabled through SaaS. In addition, there was scant human resource slack extant in IT operations, an amount such that a loss of 10% of non-managerial time would have severely impacted the ability of IT to maintain the current level of continuing operations or creative project work. In summary, the greenfield adoption of SaaS created no human resource slack in IT continuing operations. However, there was a low transfer of personnel to IT innovative project work in support of a digital business strategy. Perhaps due to a limited SaaS adoption profile, there is almost no extant human resource slack in Dyne's IT function.

One final form of slack studied by this research is that of managerial time. In spite of low to moderate adoption levels SaaS, Dyne achieved an amount of managerial time slack from within the IT Efficiency construct that was interpreted and coded as HIGH. While there was no change in managerial time devoted to routine maintenance and support activities, a productivity-enabled portion was transferred from IT Efficiency to IT Innovation and utilized to a degree interpreted and coded as HIGH. However, this form of slack was very recently annihilated through a 15% reduction in force, and the new level of managerial time slack within IT Innovation could not be ascertained. Refer to Table B4 to review the numerical rank equivalents for Case Dyne's qualitative data.

Table B4: Case Dyne interpreted and coded qualitative measures

SaaS Adoption	FinSlack Deployed	OpSlack Deployed	HRSlack Deployed	TimeSlack Deployed
Low-Moderate (1.5)	None (0.0)	None (0.0)	Low (1.0)	High (3.0)

Case Electron: Electron operates a small regional health care network connecting doctors and nurses, hospitals, clinics, diagnostic labs, pharmacies, and insurance providers in the southern United States. As a private entity, Electron has not reported their revenue growth. Their internal digital business strategy was focused solely on pervasive computing in the form of wireless communications and bring-your-own-device to support a mobile workforce and to push notifications to patients. Ultimately, Electron will deploy big data to analyze patient information, but those plans are on hold until patient records can be normalized in an electronic form.

The reason underpinning this limited focus on digital business strategy was derived from a near lack of competitive stress combined with comprehensive third-party software. Medical services, such as those coordinated by Electron, have high perceived consumer switching costs (Jones and Sasser Jr 1995), so competitive pressures are minimized. Technological intensity was high due to regulatory mandates for the nationwide creation of electronic medical records and support for the Affordable Care Act, but those aspects of a digital business strategy were wholly enacted by a licensed software package provided by one of the five major suppliers to the medical services industry. Electron did have access to the data table structure of the software database, and they were using this knowledge predominantly to create custom reports. The primary concern of the CIO was supporting a high quality of patient care through maintaining data availability, and in support of this direction they had adopted no instances of SaaS, even though the third-party enterprise software is available in that form. As such, there adoption level of SaaS may be computed as follows:

1) Functional department use – NONE
2) Age of first deployment –ZERO
3) Budgetary commitment – NONE

4) Value chain penetration – NONE

5) Employee work requirement – NONE

6) Total SaaS adoption profile – NONE

In light of the zero-level for SaaS adoption, there was no slack of any variety produced due to SaaS, but interview questions testing for the presence of extant slack in IT operations were conducted.

A 10% loss of IT budget would have resulted in an immediate cessation of new project activity combined with staff cuts, pay cuts, and a general increase in mean-time-to-repair for service calls. This level of monetary slack was coded as LOW.

Losing 10% of operational resources such as computing systems would have a significant but not catastrophic impact, due in part to the virtualization being employed in the data center and in part to a seven-year data record capacity that was growing in regular intervals. This amount of operational slack was interpreted and coded as LOW to MODERATE.

Non-managerial human resources consisted of five individuals total, so the lost of 10% of their time would have had an immediate effect such that all project work would cease or be dramatically extended and the mean-time-to-repair for continuing operations would be significantly increased. This amount of human resource slack was interpreted and coded as LOW.

The loss of 10% of managerial time, primarily those hours provided by the CIO, would have had a serious impact on continuing operations and new project work, the latter because the informant engaged in programming tasks with regard to report creation and new feature development. This level of managerial time slack was interpreted and coded as LOW to

MODERATE. Table B5 reiterates the numerical ranking for Case Electron's interpreted and coded qualitative data.

Table B5: Case Electron interpreted and coded qualitative measures

SaaS Adoption	FinSlack Deployed	OpSlack Deployed	HRSlack Deployed	TimeSlack Deployed
None (0.0)	None (0.0)	None (0.0)	None (0.0)	None (0.0)

Case Fusion: Fusion was a nonprofit institution engaged in higher education, operating as a doctoral-granting institution with higher research activity according to the Carnegie Mellon Institutional Lookup. Case Fusion had undergone enrollment declines for a number of years that have shrunk operating revenues, and state appropriations that constitute 40% of revenues were in jeopardy, both in terms of accounts receivable delays and absolute reductions. As a result, the IT function was operating with a budget that was $5 million per year less than peer institutions according to the CIO.

Their digital business strategy foci included pervasive computing in the form of wireless communications and bring-your-own-device to support a mobile faculty and student population and, more recently, cloud computing as a means to shift IT human resource requirements to third parties.

Fusion had applied the SaaS variant of cloud computing to perform learning management system (LMS) functions for both faculty and students and to support the data analysis and identification of at-risk students. Roughly 60% of the faculty used the SaaS LMS, which has been computed to be 27% of the workforce. The implementation of the enterprise software supporting accounting, finance, and marketing is hosted in an internal data center, and there is the potential to transfer from a traditional licensed to a per-seat model in the future. The CIO's involvement in the SaaS contracting efforts included financial, governance, and functional oversight. The first SaaS application went live three years ago, and their current SaaS expenditures accounted for less than 10% of the IT budget, in part to the prior CIO's adherence to an in-house operating model. A few employees in back office positions use SaaS to perform a portion of their standard business processes, but the majority of SaaS adoption is related to the LMS. Ranking the SaaS adoption profile was determined as follows:

1) Functional department use – LOW to MODERATE
2) Age of first deployment – LOW
3) Budgetary commitment – LOW
4) Value chain penetration – LOW to MODERATE
5) Employee work requirement – LOW
6) Total SaaS adoption profile – LOW

The primary reasons given for adopting SaaS were to achieve the same or better functionality that was available on an in-house licensed system followed by software upgrades, maintenance, and support in the form of externalized IT human resources due to the difficulty attracting and retaining IT talent in a semi-rural setting.

In spite of the low level of SaaS adoption, finances were affected in the form of a cost burden shift from IT to another department. The level of this monetary slack production was gauged to be NONE to LOW and the deployment of monetary slack from within IT was interpreted and coded as NONE. Because of stringent budgetary reductions, a loss of 10% of the IT budget would have been debilitating and almost catastrophic.

The transfer of the LMS from a licensed software model to SaaS resulted in the availability of only two computing servers for redeployment. This level of operational slack created in the form of computing and networking resources was interpreted and coded as LOW. As such, there was no discernable transfer of operational resources from IT Efficiency to IT Innovation as a result of SaaS adoption. With regard to the presence of existing operational slack, the loss of 10% of computing infrastructure would severely impact IT operations to a point deemed catastrophic. Enterprise business applications and networking would be impacted such that continuing operations would be strained.

While SaaS was not implemented to achieve direct cost reduction, it was selected for its ability to alleviate human resource requirements. As such, the adoption of SaaS was credited with creating IT human resource slack, a level interpreted and coded as HIGH. However, this slack was immediately consumed for both maintaining continuing operations and engaging in innovative projects. Despite a digital business strategy, there was no increase in the number of IT personnel working on innovative projects, but there was an increase in the number of projects and a concomitant increase in the allocation of resources at least part-time to those creative endeavors. The number of routine maintenance and support personnel has not changed as a result of SaaS adoption. According to the interpreted and coded responses, there was the creation of human resource slack combined with a LOW transfer of personnel from the IT Efficiency construct to IT Innovation.

In addition, there is scant human resource slack extant in IT operations, such that a loss of 10% of non-managerial time would severely impact the ability of IT to maintain the current level of continuing operations let alone maintain creative project work. In summary, the replacement model adoption of SaaS created substantial human resource slack in IT continuing operations. However, there was a low transfer of personnel/non-managerial time to IT innovative project work in support of a digital business strategy. Perhaps due to a limited SaaS adoption profile, there was almost no extant human resource slack in Fusion's IT function.

One final form of slack studied by this research is that of managerial time. In relation to a low adoption level of SaaS, Fusion achieved an amount of managerial time slack from within the IT Efficiency construct that was interpreted and coded as LOW. Yet there was a decrease in managerial time devoted to routine maintenance and support activities as a result of SaaS adoption with the excess transferred from IT Efficiency to IT Innovation and utilized to a degree interpreted and coded as MODERATE. The loss of 10% of IT managerial time was determined to be worse than catastrophic, having a more. Refer to Table B6 to review Case Fusion's qualitative data converted to its numerical equivalents.

Table B6: Case Fusion interpreted and coded qualitative measures

SaaS Adoption	FinSlack Deployed	OpSlack Deployed	HRSlack Deployed	TimeSlack Deployed
Low (1.0)	None (0.0)	None (0.0)	High (3.0)	Low (1.0)

Case Gluon: As with Case Fusion, Gluon was a nonprofit institution engaged in higher education, operating as an associate-degree granting institution with high vocational & technical according to the Carnegie Mellon Institutional Lookup. Case Gluon had undergone state-mandated consolidation with similar colleges that had resulted in an immediate expansion of the number of campuses and student population supported by their IT function. As a result of a unique governance scheme, their digital strategy is dictated by a state-level regulatory agency, and the role of their CIO is to implement the strategy locally while maintaining continuing operations. The digital business strategy foci included pervasive computing in the form of wireless communications and bring-your-own-device to support a mobile faculty and student population, and cloud computing as a means to standardize data and reporting and to provide uniform upgrades across all colleges under the normative pressure of state control.

Gluon had applied the SaaS variant of cloud computing to perform learning management system (LMS) functions for both faculty and students, and to support certain back office tasks for accounting and finance. Front office tasks such as enrollment, registration, and accounts receivable were hosted locally using licensed software so that revenue-producing operations may continue even if Internet connectivity is lost to that campus. Almost all faculty used the SaaS LMS, and together with the back office and IT staff using SaaS equated to approximately 70% of the workforce. There was no CIO involvement in the SaaS contracting efforts as they were performed at the state level. In fact, the SaaS applications were hosted as licensed software in a state data center and are then provided to colleges under its regulatory control. The first SaaS application went live 10 years ago, and their current SaaS expenditures accounted for less than 10% of the IT budget. A dozen employees in back office positions used SaaS to perform a majority of their standard business processes, but the bulk of SaaS adoption was related to the LMS. Ranking the SaaS adoption profile was determined as follows:

1) Functional department use –MODERATE
2) Age of first deployment – HIGH
3) Budgetary commitment – MODERATE
4) Value chain penetration –MODERATE to HIGH
5) Employee work requirement – MODERATE
6) Total SaaS adoption profile – MODERATE to HIGH

The primary reasons given for adopting SaaS were to achieve standardization of data, reporting, and business process management. Secondarily, SaaS was adopted to streamline upgrades across all similar colleges in the state.

Because the SaaS adoption was effected at the state level, the local IT budget was unchanged as SaaS monetary considerations don't appear in the local budgets. The level of this monetary slack production was gauged to be NONE and the deployment of monetary slack from within IT was interpreted and coded as NONE. Up to 80% of the local IT budget was allocated to service contracts, so a loss of 10% of the IT budget would have required the temporary cancellation of some service contracts. The overall effect on IT operations would have been MODERATE given that these service contracts provided additional resources.

Because the SaaS applications have been in place for a number of years, and because those contracts were negotiated and executed at the state level, there was no operational slack created in the form of computing or network resources that could be directly linked to SaaS deployments. This level of operational slack created in the form of computing and networking resources was interpreted and coded as NONE. As such, there was no discernable transfer of operational resources from IT Efficiency to IT Innovation as a result of SaaS adoption. With regard to the presence of existing operational slack, the loss of 10% of computing infrastructure would minimally impact IT operations as there was substantial redundancy and backup equipment in place.

While SaaS was not implemented to reduce personnel costs, its deployment did result in the creation of two levels of IT personnel: technicians devoted to continuing operations, and systems administrators who split their time between routine maintenance & support and innovative project work.

As such, the adoption of SaaS was credited with creating IT human resource slack, a level interpreted and coded as LOW. However, this slack was largely consumed for maintaining continuing operations, and to a lesser degree engaging in innovative projects. Human resource slack was predominantly retained by IT Efficiency because of the state-ordered consolidation that dramatically expanded the scope of IT support operations. This situation was similar to that experienced by for-profit organizations that have undergone mergers or acquisitions and eliminated redundant operations (Harrison et al. 2000). As such, the non-managerial time devoted to routine maintenance and support had increased, not as a result of SaaS adoption but due to rapid inorganic expansion. According to the interpreted and coded responses, there was the creation of human resource slack combined with a LOW transfer of non-managerial time from the IT Efficiency construct to IT Innovation.

Because the state-operated SaaS applications were provided with help desk support and because local users had direct access to that help desk, IT managers spent less time supporting those applications. The amount of managerial time slack produced by SaaS was interpreted and coded as MODERATE. Yet, due to the aforementioned consolidation, IT managers devote much of their time to routine maintenance and support for locally hosted applications and services. As such, the transfer of managerial time from IT Efficiency to IT Innovation was interpreted and coded as LOW. In addition, there is scant managerial time slack extant in IT operations, such that a loss of 10% of that time would have severely impacted the ability of IT to maintain the current level of continuing operations let alone maintain creative project work, in part due to those managers having exclusive lines of responsibility. Table B7 contains the numerical ranking for each of Case Gluon’s qualitative measures.

Table B7: Case Gluon interpreted and coded qualitative measures

SaaS Adoption	FinSlack Deployed	OpSlack Deployed	HRSlack Deployed	TimeSlack Deployed
Moderate-High (2.5)	None (0.0)	None (0.0)	Low (1.0)	Low (1.0)