Cloudrise: Opportunities and Challenges for IT Governance at the Dawn of Cloud Computing

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Abstract
Executives around the globe are investigating the benefits that cloud computing can deliver above and beyond cost savings. What is its contribution to competitiveness - through improved agility, expanded business networks, and enhanced decision-making? At the same time, organizations, and specifically IT departments, have gotten a firmer grasp on IT governance and have embraced initiatives to adjust governance strategies and structures, as well as governance processes and software. What is cloud computing’s impact on IT governance and the role of the IT department - and will it change how firms’ request, prioritize, fund, monitor, enforce, and realign IT investments? This article presents and discusses a conceptual and operational research model combining research in IT governance, cloud computing, and business/IT alignment. The model is applied to a quantitative study of 21 European and North American cloud adopters and non-adopters across various industries. Our results indeed indicate that IT organizations need to change to keep in control and that IT governance is an important means to stay relevant.

1. Introduction and Research Question
The purpose of this research is to explore the impact of cloud computing on IT governance. The term “cloud” emerged from telecommunications in the early 1990's, when virtual private network (VPN) services were established for data communications. Those networks allowed for dynamic routing and balanced utilization - in result increasing bandwidth efficiency in the “telecom cloud.” Cloud computing’s technology is very similar in providing an environment that is dynamically allocated to meet organization/user needs.

The U.S. National Institute of Standards and Technology (NIST) lists the essential characteristics of cloud computing as on-demand self-service (automated load scaling), and measured service (monitored, controlled, reported, and billed for) [1]. Resources are shared at various levels, each comprising a separate cloud offering [2, 3]: cloud infrastructure services, cloud-based development environments, and software-as-a-service (SaaS). All three offerings are explored in this study.

We consequently employ Armbrust et al.’s [4] cloud computing definition who include “both the applications delivered as services over the Internet and the hardware and systems software in the data centers that provide those services.” To avoid confusion with organizations’ (internal) data center virtualization initiatives we have only selected public clouds from the four NIST deployment modes [5]: “infrastructure […] made available to the general public or a large industry group and […] owned by an organization selling cloud services.”

An increasing body of publications indicates that those public clouds are high on corporate and IT agendas [6]. Farrell [7] estimates cloud computing’s current enterprise utilization rate at 9%, while an additional 8% of organizations have plans for adoption within the next twelve months; 36% of firms have those solutions under evaluation. Main expected benefits are [8-10]:
- Fostering cost reduction, i.e. reducing IT spend through significant scale economics that public clouds can generate over private data centers and even over private clouds;
- Accommodating fluctuating computing needs, i.e. providing short-term and “infinitely” scalable computing resources to address demand peaks and troughs;
- Enabling the agile addressing of new markets and offerings, i.e. minimizing up-front commitments of cloud users to build transactional capabilities and creating new delivery mechanisms for information-based products;
- Integrating business partners and end customers, i.e. using cloud computing to streamline business processes and information-sharing across value chains and geographies;
- Improving decision-making, i.e. employing analytical tools from the public cloud to derive insights from vast quantities of data and images within and beyond organizational boundaries - incl. social media.

Many of the above benefits are increasingly recognized and embraced by departments outside of IT, and consequently we see cloud computing solutions such as salesforce.com being selected and acquired with major - or even exclusive - involvement of departments outside of IT (e.g. marketing as in the salesforce.com example). Where IT organizations still seem to dominate cloud computing decisions in areas such as email, processing, and storage we hypothesize that the adoption of this new technology will greatly influence IT governance where it concerns the business application landscape. It will challenge the current skills of IT staff and the existing ways of working - IT departments will need to adopt to stay relevant.

Following this line of reasoning, Nicolas Carr predicts that “[i]n the long run, the IT department is unlikely to survive, at least not in its familiar form. IT will have little left to do once the bulk of business computing shifts out of private data centers and into the cloud” [11]. From his point of view, the IT organization and the CIO are either delegated to the backroom managing a commodity infrastructure or will be responsible for overseeing the transition to the cloud. IT will become a hollowed department that concerns itself with IT security, support services, and a few innovation services which are not yet mature enough to be shifted to the cloud [12].

Our study is aimed at exploring whether this is indeed happening by structuring the debate, linking it to existing research, and collecting initial empirical evidence - reflected in the research question: What is cloud computing’s impact on IT governance and the role of the IT department - and will it change how firms’ request, prioritize, fund, monitor, enforce, and realign IT investments?

The remainder of this paper is organized into five sections. In the following section “conceptual foundations and hypotheses”, earlier research relevant to the research question is assessed and hypotheses are formulated. The third section “research methodology” describes the detailed research approach, the collection of data via structured interviews and a quantitative survey, as well as the analysis approach taken. The fourth section “results discussion” presents and discusses findings and interpretations, after which the fifth and last section "conclusions and suggestions for further research" relates these findings to our overall research question and suggests next research steps.

2. Conceptual Foundations and Hypotheses

2.1. Luftman’s Maturity Model Instrument

For the purpose of this study - as a proxy for IT governance maturity - we have adopted Luftman’s Strategic Alignment Maturity (SAM) model [13, 14] - providing guidance on how to apply “IT in an appropriate and timely way, in harmony with business strategies, goals and needs”. The framework has been used by various researchers [15-19]. For this research, we apply it to contrast the differences between organizations which have already adopted cloud computing (adopters) and organizations which have not yet deployed cloud computing for productive use (non-adopters). For each firm cluster, we compare the business/IT alignment maturity in 2009 with the perceived state of affairs in 2012, i.e. a three year time difference.

We postulate that IT governance for non-cloud adopters will have progressed over these three years along Luftman’s scale which is the “natural” or “standard” IT governance maturity pattern - something we had observed over many years. For cloud adopters, we predict a more discontinuous change, with positive and negative changes across the maturity stages: communications, competency and value measurement, governance, partnership, scope and architecture, and skills. These changes are detailed in our hypotheses in section 2.2.

Each of the Luftman dimensions comprises a group of related mechanisms and assessment criteria which are important for achieving IT/business alignment. The maturity stages for each of these dimensions are a) initial/ad hoc process, b) committed process, c) established focused process, d) improved/managed process, and e) optimized process - the latter designating the highest level of maturity. The dimensions can be summarized as follows:

1. **Communications** - the regular exchange of expectations and ideas between business and IT of what it takes to support an organization’s objectives; industry and market dynamics make ongoing knowledge sharing a necessity.
2. **Competency and value measurements** - metrics and dashboards to demonstrate IT’s value to the business in terms that the business understands; service level agreements (SLAs) fall into this category and should define rewards and penalties for the providing organizations.
3. **Governance** - the formal discussion and review of IT resource allocation and priorities; included are strategic planning, demand management, as well as the scoring and selection of proposed investments.
based on costs, benefits, risk, and strategic alignment.

4. **Partnership** - the quality of relationship between business and IT and how each organization perceives the contribution of the other; ultimately, IT could both enable and drive business processes and strategies.

5. **Scope and architecture** - IT’s ability to define and adhere to technology standards while providing a flexible infrastructure; sporadically conflicting departmental and corporate interests require monitoring and control.

6. **Skills** - the human resource/people considerations for an organization; included are training, salary, performance feedback, career opportunities, as well as intangible cultural and social considerations; key is to decide which skills to keep in-house and which skills can also be provided by business partners.

### 2.2. IT Governance Definition & Hypotheses

We have chosen two IT governance definitions for this piece of research: First, Van Grembergen and De Haes [20] for a good fit with the SAM model. From their point of view, IT governance comprises a subset of corporate governance and “addresses the definition and implementation of processes, structures, and relational mechanisms in the organization that enable both business and IT people to execute their responsibilities in support of business/IT alignment and the creation of business value from IT-enabled business investments. Second, Heier et al. [21] - building on Korac-Kakabadse and Kakabadse [22] - for their process-driven approach, conceptualizing IT governance as a set of enabling mechanisms to request, prioritize, fund, monitor, enforce, and realign IT investment decisions.

Combining the framework from Luftman [13, 14] and the above definitions, we have derived a set of hypotheses (Hs) as the basis for our empirical study and depicted in figure 1. We have formulated three general hypotheses: First, we postulate that cloud adopters will have had a higher degree of business/IT alignment across all dimensions in at the starting point - compared to non-cloud adopters. It seems natural that organizations with established (IT governance) processes, skilled workforces, and architectural guidelines are more daring and capable to explore innovations (H1).

Second, we postulate that cloud adopters at best have to deal with heterogeneous enterprise architectures; at worst they will have lost a degree of control. We predict that the end point ratings on the maturity area “scope and architecture” will be significantly below the non-cloud adopters (H3). This is in line with Sethi et al. [23] who claim that cloud computing - “if not managed properly, could compound IT complexity problems as its simplicity allows business unit owners to make implementation decisions independently.”

Third and last, we postulate that cloud adopters will gain less between the survey’s starting and end points in terms of the overall strategic alignment maturity score. We hypothesize that this will be caused by the overall challenges cloud computing will place on an organization and, consequently, on its IT governance.
arrangements: while dealing with the intricacies of technology and a growing number of indirect in-house business stakeholders, as well as with technology partners, will likely leave less time to focus on IT management and governance tasks (H4).

In addition to the general hypotheses, we have derived a set of process-driven hypotheses based on Heier et al.’s [21] IT governance definition. H2.1 - “backdoor demand” - addresses requests for new IT services and functionality, or enhancements to current IT products and operations. Regardless of the degree of cloud adoption it is important that organizations manage their request queue with consistent processes and high quality input data [24, 25]. We hypothesize that cloud adopters will adopt less strict demand management: business might reach out to cloud providers without IT involvement. The maturity score in Luftman’s maturity area “governance” will decrease.

The frequency and quality of portfolio management will also be reduced for those firms. There will be less joint scoring and selection of requested investments with cloud adopters - and less formalized assessments based on organizational priorities - e.g. maximizing the portfolios’ value, staying under a certain portfolio (investment) ceiling, or linking them to strategic drivers [24, 38, 39]. The boundaries between discretionary (optional) spending and non-discretionary spending (must have) will begin to blur.

This hypothesis also addresses the commitment of financial and human resources to selected initiatives, i.e. investment funding. With cloud initiatives, it is often unclear whether business or IT are responsible for project funding and timing [25-27]. “Make or buy” decisions will regain importance as cloud computing provides convenient means to avoid capital expenditures through a shift to operating expenditures. Initiatives - which would not fit the capital expenditure ceiling before the advent of the new technology - are becoming economically feasible even for small business units as “shadow IT”.

H2.2 - “weakened partnership” - postulates that the IT department will get more detached from business. In a recent survey of European organizations 49 percent of the respondents report that non-IT departments subscribe to cloud-based services. This is evidence that IT is being bypassed as business units directly satisfy IT needs from cloud service providers [28] - clearly a weakening of Luftman’s “partnership” dimension. IT organizations will be in competition to be the partner of choice for the business, and chief information officers (CIOs) need to start transforming their departments to become service providers themselves to avoid marginalization.

When IT users turn into IT choosers - making technology decisions on their own, they effectively disintermediate the IT organization for services provision, although they might not disintermediate their natural support partner: “[l]ike Wall Street financiers, users may be well attracted to the chance to privatize reward and socialize risk. There is a danger of cloud relationships that begin as two-way user-to-vendor interaction to turn “triangular” when unhappy cloud users draw in IT for support” [29].

H2.3 - “losing control” - is closely tied to Luftman’s maturity area “scope and architecture”. Juggling the dual responsibilities for buying cloud services from external providers and providing internal services themselves, CIOs need to make faster and better informed investment decisions about the services portfolio [28]. Key performance indicators (KPIs) - including outcome and process control metrics [30-32] - focus management attention on decision outcomes and prevent opportunistic behavior through transparency [33, 34]. If problems are discovered, IT management has to take deliberate actions to mitigate wrong decisions or projects that have spun out-of-control.

Cloud computing will make it harder for the IT organization to stay involved and in control. We postulate that security implications of cloud computing will often be a second guess for cloud adopters and that some organizations might actually lose control. How would cloud-based infrastructure, development environments, and applications safely integrate with the existing systems landscape - and what degree of infrastructure flexibility is needed to address demand peaks and troughs?

We expect that architecture and security implications of potential cloud solutions will not be addressed in a sufficient manner and will therefore show a negative trend. With virtualization as a core technology component, there are security risks in losing control over data location and access. Transactional data with unclear ownership is a byproduct and it can be difficult to anticipate which data to protect. When technological processes are granted some degree of autonomy in decision making - e.g. automatically adopting services to changing customer needs - it may not be possible to determine with any specificity where data processing will take place within the cloud [35].

Some cloud adopters might fail to get basic data confidentiality, integrity, and availability (CIA) measures into place: encryption schemes to ensure that the shared storage environment safeguards all data; robust access controls to prevent unauthorized data access; and regular data backup with safe storage [2]. During the preparation for our study, many firms also expressed concerns about missing legal frameworks
governing data flows across borders, as well as about storing personal data in single vs. multiple data centers.

Enterprise architecture challenges are another flavor of “losing control”. Though Durst [36] argues that once the corporate strategy is revised, the components of an IT portfolio have to be adjusted, cloud adopters will face some difficulties here. Often “technology lock-in” [37] will occur since hardware, storage, and operating system specifications will not be considered before embarking on cloud initiatives. An organization’s cloud ecosystem ought to employ a robust enterprise architecture with elements of modularization and service-orientation “to be configurable, compostable, and manageable” [3].

“Data lock-in” [10] is a related challenge. How do cloud adopters avoid becoming reliant on a specific vendor? Data might be processes and stored in a proprietary format making it difficult to apply business intelligence (BI) or to “repatriate” the data when a cloud services is pulled back in-house. Data management inconsistencies and limited influence over cloud technologies have respectively been recognized as major adoption detriments by 76% and 56% of respondents in an A.T. Kearney study [23]. Most (IT) organizations are still immature when it comes to leveraging data and analytics for improved managerial decision making.

Key challenges are integrating “in house” data and “cloud data” since a growing portion of standing data and transactional data will shift to outside organizational boundaries, as well as nurturing and managing a culture of data analysis to support decision making. Leaders need to ask for data and staff needs to become skilled in integrating and providing information [12].

In addition to H2.2 (business taking direct ownership and introducing backdoor demand) and H2.1 (less frequent portfolio decisions taken by business and IT as partners) we hypothesize that a larger number of stakeholders will get involved in project execution. H2.4 - “losing skills” - hypothesizes that Luftman’s maturity area “skills” will suffer for cloud adopters since more work is shifted outside of the organization. Hiring, developing, and retaining an in-house workforce is becoming less important in the face of abundant skills and technology offered by cloud providers.

Some CIOs predict that the IT department will significantly shrink in size over the next ten years - but it will not become obsolete. Though they might no longer provider the range of today’s IT services, CIOs might become coordinators of the cloud ecosystem with most of the technical, day-to-day work being contributed by external business partners [38]. If firms do not adequately prepare for the advent of cloud computing they could be late in making the shift from service delivery to service management - from in-house development to vendor management.

3. Research Methodology

The (initial) explorative empirical research and testing of the hypotheses was conducted via structured interviews. Requests were sent out to 72 European and North American public and private organizations. Those organizations had previously participated in an IT management survey and indicated whether they employ cloud computing - i.e. cloud infrastructure services, cloud-based development environments, or Software-as-a-Service (Saas) - or whether they were non-adopters. Organizations which indicated that they were in the middle, or as the IT management survey phrased it “in a proof of concept (could still abandon)” were excluded. This approach allowed for comparing two extremes of the adoption spectrum and for better assessing potential differences.

As our study required data from those extreme clusters, the total population is small. The selected subset of 72 target organizations split into some 60% of cloud adopters and some 40% of non-adopters. During the exploratory phase of our research the organizations were approached in May and June 2011 with interviews conducted in the period from mid May thru mid September 2011. The companies that took part in our interviews comprised firms in the financial and insurance sector, manufacturing, information and communication, healthcare and services.

The targeted interview partners had a good knowledge of the company’s IT governance-related status in 2009 and 2012 - a three year time period also used in the previous IT management study. Since we decided to reuse some secondary data from the predecessor study, we decided not to alter the starting and end points. These preconditions meant that in most cases the (targeted) respondents were high level managers in IT (typically the CIO) or in the business with a close link to IT. A professionally designed and personally addressed interview guideline (as shown in the appendix - interview questions) and personal/ telephone interviews were used to obtain a high response rate - combined with a small reward (iPod shuffle).

In total, 21 companies took part in the interviewing round, placing the response rate/quota at approximately 30% of the total population, and providing us with data to explore the results analyzed in the following section. In addition to the reasonably high response rate, the fact that no company type/group was systematically left out of the sample, improves the representativeness
of the gathered data. Furthermore, and in order to ensure that there is no data distortion caused by the given response rate, the early responses were compared against the last responses. According to this method, several non-parametric tests were conducted for all variables indicating no significant differences between the early and late responses.

### 4. Results and Discussion

Our initial data set, described in the previous section, consists of 21 firms, split among the two extreme ends of the cloud-adoption spectrum: twelve are “cloud adopters” and nine “non-adopters” in 2012 (in 2009 all were non-adopters as cloud computing was essentially not employed yet for commercial use). Descriptive statistics for all variables mentioned in the hypotheses are presented in Table 1.

Given that the small sample size does not allow for very robust statistical tests, we primarily looked at the descriptive statistics to explore the data. Where possible we did run statistical tests to investigate whether our hypotheses hold. In the interpretation we also refer to more qualitative data we gathered as a by-product of the structured interviews. Table 2 summarizes the outcomes. As stated above, we have used business/IT alignment as a proxy for IT governance maturity: it will result in improved business processes, reduced operational (IT) costs, and enhanced visibility into business performance [39].

H1 states that firms with a higher IT governance maturity (across all dimensions) in 2009 are likelier to become cloud-adopters in 2012. Looking at the descriptive statistics we see that the mean for maturity 09 for firms that later become adopters is, at 3.13, is indeed quite a bit lower than the mean for firms that turn out to become non-adopters (2.72). At a more detailed level, for each of the dimensions individually, we see that this is true for essentially each dimension: communications 09, value measurement 09, governance 09, partnership 09 and skills 09 are higher for the firms that later turn out to be adopters. For scope & architecture 09 there is no difference.

Where all dimensions show values that are in line with our hypothesis, the identical score on the “scope & architecture” dimension for adopters and non-adopters is at first sight surprising: maturity makes no

<table>
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<th>Maximum</th>
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Table 1. Descriptive Statistics (N=21)
difference here. On second thought this is perhaps less surprising, where a higher maturity could well lead to experimentation by IT, a lower maturity score on this dimension could just as well give way to experimentation by departments outside of IT, and these two effects could compensate one another.

Note that this discussion about H1 is based here only on the means from table 1. The Mann-Whitney U test did not support our H1 hypothesis (at .05 significance level) for the overall maturity score in 2009. For the individual dimensions we did find support for both governance 09 and partnership 09 (at .05 significance level).

The H2 hypotheses relate to the change (delta) in four of the Luftman dimensions in the period 2009-2012, again comparing adopters and non-adopters. Looking strictly at the means in table 1, we can see that the positive changes in "governance" and "partnership" scores clearly fall behind for the cloud adopters (they are actually close to 0, with several interviewees reporting a decrease, suggesting that "backdoor demand" and "weakened partnership" are real indeed, definitely in comparison to non-adopters. Using the independent-samples Mann-Whitney U test with a significance level of .05 we find support for both H2.1 (governance delta) and H2.2 (partnership delta).

Given that our interviewees were almost all high-ranking IT executives who were discussing their own organization (and in a way their own performance) one can realistically expect that there is a bias towards reporting a more positive picture, so the real situation may be more serious. Comparing the differences between the deltas for each group is therefore probably the best indicator. Although we do not have deeper first-hand knowledge of all organizations that were interviewed, our own observations do suggest that this may very well be the case.

The hypothesized smaller increase for adopters in the "scope and architecture" (H2.3) and the "skills" dimension (H2.4) are also in line with the means in table 1, although the differences are relatively small. Using the same statistics tests we find no support for either of these two hypotheses.

One might argue that hypothesis H2.3, which was summarized earlier as the IT department "losing control", incorrectly assumes that the IT department was "in control" in 2009; as the data for H1 indicate, the firms that later have become adopters had comparatively already "lost control" in 2009. The fact that this situation does not worsen due to the adoption of cloud computing is interesting, and indicates that these firms, as discussed earlier, may already have had a “hollowed” IT department concerned primarily with basic IT infrastructure services.

H3 hypothesizes that, in absolute values, “scope and architecture” for cloud adopters will be below non-adopters in 2012. With means in 2012 of 3.31 for adopters and 3.59 for non-adopters respectively, this is indeed in line with H3. The Mann-Whitney U test (with a significance level of .05) does not confirm this apparent weaker enterprise architecture alignment. H4, finally, states that cloud adopters will gain less between 2009 and 2012 in terms of the overall strategic alignment maturity score. Looking at the means in table 1 (for the maturity delta), this is confirmed, but the difference is not very pronounced and the Mann-Whitney U test (with a significance level of .05) does not confirm this.

<table>
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<td>H1(+) &quot;higher maturity of adopters&quot;</td>
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<tr>
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<td>H3(-) &quot;weaker enterprise architecture alignment&quot;</td>
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<td>H4(-) &quot;less gain of adopters&quot;</td>
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</table>

Table 2. Overview of Hypotheses (Mann-Whitney U test, sig =0.05, N=21)

5. Conclusions and Suggestions for Further Research

Our research has shown that business/IT alignment, as measured by the SAM model, is affected by whether or not firms adopt cloud computing. Cloud adopters report less growth in their overall alignment maturity, and remain essentially stagnant on the “governance” and “partnership” dimensions. This does not necessarily imply that embarking on cloud computing is, as such, a bad decision for IT departments or firms in general, but is does suggest that proper IT governance is very important to guide cloud adoption and to ensure that alignment maturity develops
positively and that IT departments stay relevant in this new era of cloud computing.

For instance, while services provision from the IT organization may well diminish, services support is likely to increase in relevance - e.g. certification of cloud computing providers and federated security models to protect the organizational boundaries. The previously discussed “backdoor demand” - with services being selected and acquired with sometimes exclusive involvement of departments outside of IT - will require explicit definition and mandate of enterprise policies which were formerly embedded in institutional service delivery.

In this scenario, the emphasis may shift from “hard governance” - i.e. the control over services provision and funds - to “soft governance” - e.g. monitoring cloud usage, providing certifications, managing identities, assessing the efficiency of technology-enabled cross-departmental processes, and managing organization-wide information architecture.

While the results from this study indicate the general direction for IT governance and alignment as a result of cloud adoption, clearly more data are needed to solidify the results. We are also early in the process of cloud adoption, and while it is very important to have early results, future studies may well show differences over time, per industry or for different geographic regions. More qualitative studies may also help to interpret survey results and offer more detailed explanations for these results.

References


