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A Study of Cloud Computing Software-as-a-Service (SaaS) in Financial Firms

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Abstract

Cloud computing is a delivery method of information systems that is being deployed by the financial industry. Software-as-a-Service (SaaS) is the more frequent model of this method in the industry. In this study the authors analyze factors that can enable firms in the financial industry to formulate cloud computing strategy from a foundational investment in SaaS. The authors learn that business and procedural factors are more critical than technical factors as drivers in an implementation strategy. The findings of the study contribute guidance into the formulation of strategy from initial investments in the technology.

Keywords: cloud computing, financial industry, information systems, software-as-a-service (SaaS), strategy.

1. DEFINITIONS OF CLOUD COMPUTING AND SOFTWARE-AS-A-SERVICE (SaaS)

Cloud computing is defined as "a [method that enables] convenient, on-demand network access [by a financial firm] to a shared pool of configurable computing resources … that can be provisioned rapidly and released with minimal management effort or [cloud] service provider [CSP] interaction" (Walz & Grier, 2010).

This delivery method of information systems enables agility in the deployment of firm initiatives, elasticity and flexibility in the scalability of services, and especially cost investment maintenance (Ahuja & Rolli, 2011) and overhead procurement savings (Nimsoft, 2011) in technology. This method enables productivity savings in the integration of social networking technologies (Boulton, 2011). Most firms in industry have at least one cloud service (Black, Mandelbaum, Grover, & Marvi, 2010).

The method is hyped as one of the leading technologies in 2011 (Luftman, 2011).

Software-as-a-Service (SaaS) is defined as an Application-as-a-Service (AaaS) model:

"The capability [furnished] to the [financial firm] is to apply the [SaaS cloud service] provider's applications running on a cloud infrastructure; the applications are accessible from … client devices through a thin client interface, such as a Web browser (e.g. Web-based e-mail); and the [financial firm] does not control nor manage the underlying cloud infrastructure, including networks, operating systems, servers, storage or even individual application capabilities, with the … exception of limited [financial firm] – specific application configuration settings" (Mell & Grance, 2011, p.1).

2. INTRODUCTION TO STUDY OF FINANCIAL FIRMS AND SOFTWARE-AS-A-SERVICE (SaaS)

Financial firms are deterred frequently from investment in cloud computing delivery methods because of concerns documented in the literature. Cloud computing methods of Software-as-a-Service (SaaS) can be considered black box models in which financial firms may become dependent on a cloud service provider (CSP) but not be knowledgeable of the hosting latency and location of the technology (Streeter, 2011). Cost savings may be elusive on complex migration models of cloud computing (Violino, 2011). Data privacy, regulation and reliability of services may be issues to the firms in the outsourcing of SaaS systems (Rocha, Abreu, & Correia, 2011), evident generally in mishaps and outages of services of Amazon EC2 (Prigge, 2012), Google Gmail (O'Shea, 2011), and Microsoft Azure (Prigge, 2012). Inconsistent portability and security standards of the CSP may be a further issue in precluding firms in the financial industry from investment in SaaS (Ortiz, 2011). The immaturity of the CSP in this particular industry may be an issue in precluding SaaS systems. The information systems departments in this industry may be resistant to SaaS, as they may perceive a loss of management power if systems are proceeding to the cloud (Black, Mandelbaum, Grover, & Marvi, 2010). The forecast for cloud computing methods may be hindered in the financial industry by the issues in the literature.

Firms in the financial industry have however implemented projects in cloud computing. More than 50% of the industry is estimated to have initiated investment in SaaS models in 2011 (Aite Group, 2011). Projects have included collaboration, desktop and e-mail systems (Narter, 2011) and customer relationship management (CRM) systems at 25% of the market (Klie, 2012). CRM SaaS systems have integrated customer service in the firms (Klie, 2011, Gonzalez, 2011, & Adams, 2012). More than 50% of the processing in the institutions is forecasted to be serviced by cloud models in 2015 (Titlow, 2011). This industry market in cloud computing models is forecasted to be $27 billion in 2015 (Cofran, 2011). More of the SaaS systems might be in medium-sized to small-sized initiatives than in large-sized initiatives (Pring, 2010) that have problematic spaghetti systems. Though firms in the financial industry indicate issues in the investment in cloud computing models, they have implemented projects and systems in a frequency higher than might be expected from the issues – "a gold rush of the 21st century" (Kondo, 2011, p.1-6) that might or might not be enabled by a strategy.

In the study the authors attempt to discern factors that are enabling financial firms to formulate or not formulate a cloud computing path from an investment in SaaS, so that managers can replicate a creditable strategy. Exploration of cloud computing technology is facilitated frequently in projects of SaaS (McAfee, 2011). Exploration of SaaS is important in the formulation of strategy as CSP firms in the technology industry furnish perceived holistic Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and SaaS services and technologies (Pring, 2010). Financial firms having a cloud computing strategy may improve the integration of their technologies (Gubala, 2011). How are firms in the financial industry initiating or not initiating a cloud computing strategy from SaaS? Is the hype in front of reality? (Taneja Group, 2011). Neither practitioner nor scholarly literature furnishes a full SaaS framework for granular interpretation of a methodology on cloud SaaS systems. The authors of this study furnish a factor framework for a methodology for a holistic strategy from the best practices on SaaS projects and systems in the financial industry.

3. FACTOR FRAMEWORK IN A CLOUD COMPUTING SAAS STRATEGY – MODEL OF STUDY

The factors for enabling firms in the financial industry to implement projects in a cloud strategy from an investment in SaaS are defined in business, procedural and technical categories. These factors are derived and justified from an earlier model of the authors on cloud computing strategy (Lawler, Barber, Yalamanchi, & Joseph, 2011), from which they analyzed a broad cross-section of firms in industry that had IaaS, PaaS and SaaS. This study expands literature on initial methodology of cloud computing strategy (Peiris, Sharma, & Balachandran, 2011). In this study the authors analyze a closer section of firms in the financial industry that have had SaaS projects and systems. The factors are enhanced by the authors for the functionality of SaaS systems. The framework of the factors is founded on even further models of the authors on Service-Oriented Architecture (SOA) (Lawler & Howell-Barber, 2008) and Web services (Lawler, Anderson, Howell-Barber, Hill, Javed, & Li, 2003), inasmuch as services and SOA are a forefront to cloud technology.

Business Factors in Cloud Computing SaaS Strategy

The business factors of the model on cloud computing SaaS strategy are below:

Agility and Competitive Edge- extent to which improved agility in dealing with competitive markets and customer demands enabled cloud implementation of SaaS;

Cost Benefits – extent to which financial considerations enabled implementation of SaaS;

Executive Involvement of Business Organization(s) – extent to which participation of senior managers from business organization(s) enabled implementation of SaaS;

Executive Involvement of Information Systems Organization – extent to which participation of senior managers from internal information systems organization enabled implementation of SaaS;

Organizational Change Management – extent to which organizational change management processes enabled implementation of SaaS;

Participation of Client Organizations – extent to which client organizational staff enabled implementation of SaaS;

Regulatory Requirements – extent to which governmental or industry regulatory requirements enabled implementation of SaaS; and

Strategic Planning – extent to which organizational strategy planning of the cloud enabled implementation of SaaS

Procedural Factors in Cloud Computing SaaS Strategy

The procedural factors of the model on cloud computing SaaS strategy are below:

Education and Training – extent to which cloud methodology skills training enabled cloud implementation of SaaS;

Financial Planning – extent to which client organizational financial planning enabled implementation of SaaS;

Process Management – extent to which client organizational and technological process management, including process responsibilities and roles, enabled implementation of SaaS;

Program and Project Management – extent to which program and project management teams enabled implementation of SaaS;

Risk Management – extent to which processes for review of cloud service providers (CSP), including cloud computing bill of rights and service level agreements (SLA) integrated into organizational risk management processes, enabled implementation of SaaS;

Service-Oriented Architecture (SOA) – extent to which SOA enabled implementation of SaaS;

Standards – extent to which open standards, participation in standards organizations, or processes of standards management enabled implementation of SaaS; and

Technology Change Management – extent to which technology change management, including CSP selection, enabled implementation of SaaS

Technical Factors in Cloud Computing SaaS Strategy

The technical factors of the model on cloud computing SaaS strategy are below:

Business Application Software – extent to which cloud service provider (CSP) software enabled cloud implementation of SaaS;

Cloud Computing Center of Excellence – extent to which a cadre of internal organizational staff, knowledgeable in best practices of cloud computing technology, enabled implementation of SaaS;

Cloud-to-Cloud Hybrid Integration – extent to which integration of the cloud with other internal or external cloud systems enabled implementation of SaaS;

Cloud-to-Non-Cloud Integration – extent to which integration of the cloud with other internal or external non-cloud systems enabled implementation of SaaS;

Continuous Processing – extent to which 24/7/365 processing and scalability of cloud resources of technology enabled implementation of SaaS;

Data – extent to which information management ownership processes and resources enabled implementation of SaaS;

Elasticity of Processing Resources – extent to which resource synchronization enabled implementation of SaaS;

Infrastructure Architecture – extent to which implementation of SaaS integrated with the infrastructure architecture of the internal organization;

Multiple Cloud Service Providers (CSP) – extent to which interactions with multiple CSPs enabled implementation of SaaS;

Networking Implications – extent to which networking infrastructure of the internal organization enabled implementation of SaaS;

Platform of Cloud Service Provider (CSP) – extent to which CSP platform of technology enabled implementation of SaaS;

Privacy and Security – extent to which CSP and organizational privacy and security steps enabled implementation of SaaS;

Cloud System Problem Management – extent to which management and monitoring, including problem management tools, enabled implementation of SaaS; and

Tools and Utilities – extent to which CSP tools and utilities enabled implementation of SaaS

4. FOCUS OF STUDY

The focus of the authors is to evaluate the aforementioned factors of the model of the study in the cloud implementation of Software-as-a-Service (SaaS) projects and systems in financial firms; and to evaluate the projects and systems in the feasibility of initiation of a larger cloud computing strategy. Financial firms have increased investment in cloud innovation (Gubala, 2011) even though there are issues on this computing method, and the frequent investment is in the model of SaaS, which may furnish or not furnish a foundation of a larger strategy. The foundation is crucial for financial firms in pursuing new technologies (Aishawi & Arif, 2011). The authors evaluate the factors of the model of this study as applied or not applied as best practices on projects and systems of SaaS and of strategy. This study contributes input for this industry into the formulation of a practical cloud computing strategy.

5. RESEARCH METHODOLOGY OF STUDY

The research methodology of this study consisted of a sample of 26 financial firms that have had cloud computing Software-as-a-Service (SaaS) projects and systems, as defined in Table 1 of the Appendix. The projects and systems were analyzed by the authors in the following iterative 9 month period of study:

- In the period of September 2011 – March 2012, a graduate student in the Seidenberg School of Computer Science and Information Systems of Pace University, the third author of the study, conducted a literature survey of 21 firms in the financial industry on SaaS projects and systems. The firms were chosen because of aggressive innovation in SaaS cited in credible leading practitioner publications in the industry, such as *Bank Technology News* and *Wall Street and Technology*. From a checklist instrument

defining the 30 business, procedural and technical factors of the model of the study, the student evaluated enablement of the factors on the key SaaS projects and systems in each of the 21 firms. To the factors the student applied a six-point Likert-like rating scale of 5 – very high, 4 – high, 3 – intermediate, 2 – low, 1 – very low and 0, in perceived enablement evidence of the factors in the implementation of the SaaS systems, and the second and fourth authors evaluated the instrument in the context of construct, content and face validity, and content validity was measured in the context of sampling validity;

- In the period of November 2011 – May 2012, an experienced practitioner in the financial industry and in SaaS systems, the first author of the study, conducted a detailed case study based on principles of Yin (Yin, 2003), separate from the limited generic survey, of a further 5 firms in the financial industry on SaaS projects and systems, in order to refute or not refute the findings of the graduate student and second author. The 5 firms were chosen by the first author because of distinguishing first mover innovation and payback in reengineering technology cited by leading consulting organizations, such as Gartner, Inc. and International Data Corporation (IDC) Research Services. From the aforementioned checklist instrument of 30 factors, the first author evaluated enablement of the factors on the key SaaS projects in each of the 5 firms, based on in-depth observations of 13 middle management stakeholders in these firms; on her perceptions of the observation rationale as an industry practitioner of 36 years; and on reviews of secondary studies, such as from IBM, Microsoft and Oracle, as they purely related to the project technologies, but filtered for hype in marketing of these technologies. The first author applied the aforementioned rating scale in perceived enablement evidence of the factors in the implementation of the SaaS systems. This author evaluated further the feasibility of initiation of a future if not larger cloud computing strategy;

- In the period of March – June 2012, the fourth author interpreted the data from the evaluations in the case study and the literature survey, but focusing more on the case study, in the MATLAB 7.10.0 statistics Toolbox in measurements (McClave & Sincich, 2006) for the analysis in the following section.

(The methodology of the study is consistent in creditability and reliability with the methodology employed in earlier studies of the authors (Lawler, Anderson, Howell-Barber, Hill, Javed, & Li, 2003, & Lawler, Howell-Barber, Yalamanchi, & Joseph, 2011) on services strategies.)

6. ANALYSIS OF FINDINGS

Collective Analysis of 21 Financial Firms from Survey

As a precursor to the case study, the firms in the survey emphasized more business factors and procedural factors than technical factors on the projects of SaaS. The findings highlighted the business factor of *agility and competitive edge* (4.05 / 5.00) [Table 2 of the Appendix] as a contributor frequently to the projects, and the enabling factors of *executive involvement of business organizations* (4.05), *executive involvement of information systems organization* (4.52), *participation of client organizations* (4.19) and *regulatory requirements* (4.00) were high on the projects. The procedural factors of *education and training* (4.33) and *process management* (3.95) facilitating methodology were generally high on most projects. The technical factors however of *business application software* (2.86) *coupled to tools and utilities* (0.52), *multiple cloud service providers* (0.43), *platform of providers* (0.29) and *networking implications* (0.10) were generally low on the projects. The factors of *cloud-to-cloud hybrid integration* (0.90) and *cloud-to-non-cloud integration* (1.05), and *infrastructure architecture* (0.95), *organizational change management* (3.00) and *strategic planning* (3.14) relating to SaaS strategy if not integrated PaaS and IaaS strategy, were mixed in the survey.

The findings highlighted that these firms in the survey focused more on an elemental evolving of a foundation for an incremental model of SaaS, in short-term objectives of the projects that inevitably limited strategy.

(Factors analyzed in the survey are collectively summarized in Tables 2 and 3 of the Appendix.)

Detailed Analysis of 5 Financial Firms* from Case Study

Firm 1: Loan Marketing Project: Human Resource SaaS System

Firm 1 is a *large-sized* northeast educational loan marketing organization that focused on a PeopleSoft human resource system. The objective of the project was to discontinue an expensive internal legacy process and system that were not expandable fast enough for further feature functionality; and engage an external cloud service provider (CSP) system that in the future might link to a provider financial system. The project resulted in a new on-demand system that is expandable in functionality in months not years.

The business factors of *executive involvement of business organization* (5.00 / 5.00) [Table 4 of the Appendix] and *executive involvement of information systems organization* (5.00) were contributors to the project. The procedural factors of *process management* (4.00) and *technology change management* (5.00) were a foundation for process management of the project. The procedural factor of *risk management* (4.00) and the technical factor of *privacy and security* (5.00) were important in the management of *data* (4.00) information. The eventual integration of the human resource system with the financial system was important in the *cloud-to-cloud hybrid integration* (5.00). Not evident in importance was *elasticity of processing resources* (1.00) in the future geometric scalability of the new financial system. Not evident in *infrastructure architecture* (0.00) was a foundation for a future SaaS if not PaaS strategy.

Firm 1 was essentially focused more on business and procedural factors than on technical factors, in a cautious and helpful incremental model of SaaS that was limited to short-term objectives that precluded a cloud computing strategy.

Firm 2: Banking Project: Customer Relationship Management (CRM) SaaS System

Firm 2 is a *large-sized* mid-west banking organization that focused on a Salesforce.com system. The objective of the project was to enable disconnected and expensive customer relationship management processes into an integrated system. The project resulted in a new provider solution that integrated the processes of marketing, sales and service into one system, from which the divisions of the firm had a holistic picture of household relationships.

The business factor of *agility and competitive edge* (5.00) was the driver of the project, but *executive involvement of business organizations* (5.00), *executive involvement of information systems organization* (5.00) and *participation of client organizations* (5.00) of the firm were enabling factors. The procedural factors of *process management* (5.00), *program and project management* (4.00) and *technology change management* (5.00) and especially *education and training* (5.00) were a foundation for methodology. The procedural factor of *risk management* (5.00) and the technical factor of *privacy and security* (5.00) were important in the management of *data* (5.00) information, as in Firm 1. More evident in Firm 2 was the importance of the cloud computing skills of the internal staff in an established *cloud computing center of excellence* (5.00). More evident in Firm 2 in *strategic planning* (4.00) and *infrastructure architecture* (4.00) was initiation of a SaaS strategy.

Firm 2 was focused more on business factors than on procedural and technical factors. However the provider furnished help in infrastructure strategy that may be further helpful in project planning of SaaS strategy. Investment in the skills of the internal staff was notable in the study.

Firm 3: Banking Project: Content Management SaaS System

Firm 3 is a medium-sized mid-west banking organization that focused on a CrownPeak content management and optimizer system. The objective of the project was to enhance inefficient content management processes of an extranet Web site that was maintained manually by a few staff. The project resulted in a new provider system that exponentially improved maintenance marketing of new products and resources and publicized searching on the site.

In Firm 3 the business factors of *executive involvement of business organizations* (5.00) and *participation of client organizations* (5.00) were the drivers of the full project, as the client divisions controlled the project and depended largely on the provider. Differing from Firms 2 and 1, the disadvantage was that the internal

systems department was less a player in *executive involvement of information systems organization* (3.00) than the provider. The procedural factor of *process management* (5.00) was important in the methodology of the project, but was not improved in the other procedural factors. Evident in importance as in Firm 2 was cloud computing skills of the internal client department staff in another *cloud computing center of excellence* (5.00). Not evident was future independent planning of projects in *cost benefits* (2.00) and *financial planning* (2.00) or planning of a SaaS strategy in *infrastructure architecture* (0.00) and *strategic planning* (2.00).

Firm 3 was cautiously focused more on business factors than on the other factors, but, by focusing on the provider and not integrating the internal systems staff, was limited to short-term objectives of projects that precluded strategy.

Firm 4: Insurance Project: Homeowner Policy Management SaaS System

Firm 4 is a *small-sized* northeast insurance organization that focused on a EXIGEN homeowner policy management system. The objective of this project was to improve the performance and policy processing of a legacy system that was not current in customer requirements and governmental regulations. This project resulted in a provider system that improved issuance of policies, processing of rates, and self-service through the Web.

The business factors of *agility and competitive edge* (5.00) and *regulatory requirements* (5.00) were the critical drivers of this project, and, in contrast to Firm 3, the internal systems department was more a player in *executive involvement of information systems organization* (5.00). The disadvantage however was the client departments were not as strong in *executive involvement of business organizations* (2.00) and in *participation of client organizations* (2.00). The procedural factor of *process management* (5.00) was also important in the methodology of this project, as it was in Firms 3, 2 and 1, but the other procedural factors were limited in robustness. Skills of the systems staff in *cloud computing center of excellence* (5.00) coupled to *education and training* (3.00) were important on this project, as they were in Firms 3 and 2. Strategy was evident further in *strategic planning* (4.00), but was limited in this study.

Firm 4 was focused more on the business factors as in the other firms of the case study. The internal systems staff was positioned as players in providing a potential SaaS strategy, but they will require the internal client staff stakeholders in a productive strategy. The investment in the SaaS skills of the systems staff was a recurring study theme.

Firm 5: Investment Banking Project: Disaster Recovery SaaS System

Firm 5 is a small-sized western organization that focused on an EVault data protection and disaster recovery system. The objective of this final project of the case study was to initiate a data protection system for information on customers of the firm; and install a faster recovery system of the information by limited Firm personnel. This project resulted in an outsourced storage system that protected the information and provided reliable remote recovery services.

In contrast to Firms 4, 3, 2 and 1, the technical factors were the drivers of this project. *Continuous processing* (5.00), *data* (5.00), *elasticity of resources* (5.00), *infrastructure architecture* (5.00) and *networking implications* (4.00) were the important indices of this project, managed by the information systems division staff in *executive involvement of information systems organization* (5.00). The business factor of regulatory *requirements* (5.00), the procedural factor of *risk management* (5.00), and the technical factor of *privacy and security* (5.00) were the key impetus to this project. The procedural factor of *process management* (4.00) was important in methodology, as it was in Firms 4, 3, 2 and 1. In-house skills of the special staff in the *cloud computing center of excellence* (5.00) of the technology division were important on this project, as they were in Firms 4, 3 and 2. Not evident in *strategic planning* (2.00) was a SaaS project strategy.

Firm 5 was cautiously focused on technical factors of a narrow project that precluded strategy, but the project might furnish the potential of a strategy if further projects of this small-sized organization proceed on the cloud.

*Firms are confidentially identified in the case study because of competitive considerations in the financial industry.

(Factors analyzed in the case study are detailed in Tables 4 and 5; and factors in the consolidated case study and survey are detailed in Tables 6 and 7.)

Collective Analysis of 5 Financial Firms from Case Study – Summary

In further interpretation, the analysis discloses the business factors as a category having the more desirable means (central tendency) and standard deviations (spread) and the technical factors as a category having the less desirable means and deviations. This is evident in the case study and the survey. Though several of the factors – business, procedural and technical – are evaluated higher or lower in the case study than in the survey, the level of the category ratings are largely similar in the overall study. The patterns of the ratings of the factors across the categories of the factors of the firms in the case study and the survey seem to be also similar in the overall study. There are from ANOVA no statistical differences at the 0.05 level of significance between the business, procedural and technical factors or between the firms in the case study and survey, as evidenced by p values and by differences in factor means.

7. IMPLICATIONS OF STUDY

Financial firms analyzed by the authors are clearly clients of the model of Software-as-a-Service (SaaS), not refuting the generic literature (Friedenberg, 2011). The firms chose appropriate projects and systems and considered the impact of departmental experience and organizational performance of SaaS. The projects and systems are contributing benefits to the firms from the model of SaaS, even unanticipated benefits. Even with the benefits, the firms are cautiously, not exuberantly, experimenting in the fundamental model of SaaS, because of cited concerns of control, immaturity of the cloud method and security of the systems, contradicting the literature (InfoWorld, 2011). The enabling experimentation of SaaS as a feature in the implementation of systems in this industry is an implication of this study.

Firms in the case study and survey are examples of an incremental model of SaaS, a finding found by the authors in their 2011 study (Lawler, Howell-Barber, Yalamanchi, & Joseph, 2011). The firms are focused generally on medium-sized and small-sized systems of SaaS that in impact of implementation are perceived by the authors as inevitably sporadic throughout the organizations. Though the authors are cognizant of the cited consensus on the cloud, the firms in the study are not fully leveraging the potential of the cloud as a new opportunity proposition (Overby, 2011). They are not leveraging SaaS towards the platform spectrum of PaaS or IaaS, though they are methodically but slowly (Wittmann, 2012) moving into this spectrum. The implementation of SaaS in an incremental model limiting the myriad potential of the cloud is another implication if the study.

Few of the firms exhibit a larger cloud strategy. The projects and systems exhibit short-term objectives, a finding found in the literature (Nuciforo, 2012), not long-term objectives that may be the foundation for a holistic SaaS, PaaS and IaaS platform strategy. The systems were tactical (Linthicum, 2012). This may impact integration of later systems and modifications preventable if the firms had a strategy. This limits the potential of SaaS as a strategy. The methodology of the study may facilitate however the initiation of a migration strategy, if applied rigorously by the chief information officers (CIO) of the information systems departments to forthcoming implementations of the infrastructure of future systems, and if the information systems departments are not fearful of an inherently outsourcing strategy (Thibodeau, 2011). The implementation of SaaS in meeting short-term objectives but limiting the potential of a strategy is a final implication of the study.

8. CONCLUSION OF STUDY

Cloud computing is continuing to be deployed in industry despite concerns of dependency, organizational politics, privacy, regulation and reliability and security. The emphasis of the study on the model of Software-as-a-Service (SaaS) in the financial industry is disclosing from a case study and a literature survey that technical factors of functionality are less critical than procedural and business factors in the implementation of SaaS projects and systems in this industry. The findings are indicating that a foundational investment in SaaS technology may facilitate the potential of a larger cloud computing strategy, integrating Platform-as-a-Service (PaaS) and Infrastructure-as-a-Service (IaaS) technologies, if the framework methodology of the study is applied further to future systems. These findings furnish input

into the formulation of an improved cloud computing strategy that may benefit manager practitioners in financial and non-financial industries. This study offers opportunities for new research that will be pursued by the authors.

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APPENDIX

Table 1: Summary of Financial Firms and SaaS Systems

- Financial Firms -			
Financial Industry Sector	**Survey**	**Case Study**	**Total**
Asset Management	1	-	1
Banking	6	2	8
Brokerage	1	-	1
Financial Services	4	-	4
Insurance	4	1	5
Investment Banking	3	1	4
Loan Savings	2	1	3
Total	21	5	26

Graduate Student Survey

Table 2: Collective Detailed Analysis of Factors of 21 Financial Firms from Graduate Student Survey

Factors of Model	**Means**	**Standard Deviations**
Business Factors		
Agility and Competitive Edge	4.05	1.07
Cost Benefits	3.57	1.69
Executive Involvement of Business Organization(s)	4.05	1.24
Executive Involvement of Information Systems Organization	4.52	1.12
Organizational Change Management	3.00	1.64
Participation of Client Organizations	4.19	0.87
Regulatory Requirements	4.00	1.41
Strategic Planning	3.14	0.96
Procedural Factors		
Education and Training	4.33	1.15
Financial Planning	2.76	1.22
Process Management	3.95	1.53
Program and Project Management	2.76	1.79
Risk Management	4.19	1.54
Service-Oriented Architecture (SOA)	1.29	1.45
Standards	0.90	1.70
Technology Change Management	3.76	1.37
Technical Factors		
Business Application Software	2.86	2.03
Cloud Computing Center of Excellence	2.52	1.57
Cloud-to-Cloud Hybrid Integration	0.90	1.61
Cloud-to-Non-Cloud Integration	1.05	1.66
Continuous Processing	0.67	1.28
Data	1.76	1.79
Elasticity of Processing Resources	0.48	1.25
Infrastructure Architecture	0.95	1.47
Multiple Cloud Service Providers (CSP)	0.43	1.36
Networking Implications	0.10	0.30
Platform of Cloud Service Provider (CSP)	0.29	0.78
Privacy and Security	2.38	2.36
Cloud System Problem Management	0.38	0.80
Tools and Utilities	0.52	1.21

Legend: 5 – Very High, 4 – High, 3 – Intermediate, 2 – Low, 1 – Very Low, and 0 in Enablement Evidence in Implementation of SaaS Systems

Table 3: Summary Analysis of Categorical Factors of 21 Financial Firms from Graduate Student Survey

Categorical Factors of Model	Means	Standard Deviations
Business Factors	3.82	0.53
Procedural Factors	2.99	1.32
Technical Factors	1.09	0.91

Industry Practitioner Case Study

Table 4: Detailed Analysis of Factors of 5 Financial Firms from Industry Practitioner Case Study

Factors of Model	Firm 1	Firm 2	Firm 3	Firm 4	Firm 5	Summary	
	Loan Savings	Banking	Banking	Insurance	Investment Banking		
	Means	Means	Means	Means	Means	Means	Standard Deviations
Business Factors							
Agility and Competitive Edge	3.00	5.00	5.00	5.00	3.00	4.20	1.10
Cost Benefits	4.00	4.00	2.00	3.00	5.00	3.60	1.14
Executive Involvement of Business Organization(s)	5.00	5.00	5.00	2.00	0.00	3.40	2.30
Executive Involvement of Information Systems Organization	5.00	5.00	3.00	5.00	5.00	4.60	0.89
Organizational Change Management	1.00	3.00	4.00	1.00	0.00	1.80	1.64
Participation of Client Organizations	4.00	5.00	5.00	2.00	0.00	3.20	2.17
Regulatory Requirements	2.00	5.00	5.00	5.00	5.00	4.40	1.34
Strategic Planning	4.00	4.00	2.00	4.00	2.00	3.20	1.10
Procedural Factors							
Education and Training	2.00	5.00	2.00	3.00	0.00	2.40	1.82
Financial Planning	5.00	1.00	2.00	1.00	4.00	2.60	1.82
Process Management	4.00	5.00	5.00	5.00	4.00	4.60	0.55
Program and Project Management	0.00	4.00	2.00	1.00	0.00	1.40	1.67
Risk Management	4.00	5.00	3.00	3.00	5.00	4.00	1.00
Service-Oriented Architecture (SOA)	1.00	0.00	0.00	0.00	0.00	0.20	0.45
Standards	0.00	0.00	0.00	3.00	0.00	0.00	0.00
Technology Change Management	5.00	5.00	2.00	2.00	0.00	2.80	2.17
Technical Factors							
Business Application Software	5.00	5.00	5.00	5.00	5.00	5.00	0.00
Cloud Computing Center of Excellence	2.00	5.00	5.00	5.00	5.00	4.40	1.34
Cloud-to-Cloud	5.00	0.00	0.00	0.00	0.00	1.00	2.24

Hybrid Integration							
Cloud-to-Non-Cloud Integration	1.00	5.00	0.00	2.00	0.00	1.60	2.07
Continuous Processing	0.00	0.00	0.00	1.00	5.00	1.20	2.17
Data	4.00	5.00	4.00	1.00	5.00	3.80	1.64
Elasticity of Processing Resources	1.00	0.00	0.00	0.00	5.00	1.20	2.17
Infrastructure Architecture	0.00	4.00	0.00	0.00	5.00	1.80	2.49
Multiple Cloud Service Providers (CSP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Networking Implications	0.00	0.00	0.00	0.00	4.00	0.80	1.79
Platform of Cloud Service Provider (CSP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Privacy and Security	5.00	5.00	4.00	1.00	5.00	4.00	1.73
Cloud System Problem Management	0.00	1.00	0.00	0.00	0.00	0.20	0.45
Tools and Utilities	3.00	5.00	5.00	2.00	5.00	4.00	1.41

Table 5: Summary Analysis of Categorical Factors of 5 Financial Firms from Industry Practitioner Case Study

Categorical Factors of Model	Means	Standard Deviations
Business Factors	3.55	0.89
Procedural Factors	2.25	1.65
Technical Factors	2.07	1.78

Graduate Student Survey and Industry Practitioner Case Study

Table 6: Summary Analysis of Categorical Factors of All 26 Financial Firms from Survey and Case Study

Categorical Factors of Model	Means	Standard Deviations
Business Factors	3.76	0.57
Procedural Factors	2.85	1.35
Technical Factors	1.28	1.04

Table 7: Summary Analysis of Factors of All 26 Financial Firms from Survey and Case Study

Factors of Model	Means	Standard Deviations
Business Factors		
Agility and Competitive Edge	4.08	1.06
Cost Benefits	3.58	1.58
Executive Involvement of Business Organization(s)	3.92	1.47
Executive Involvement of Information Systems Organization	4.54	1.07
Organizational Change Management	2.77	1.68
Participation of Client Organizations	4.00	1.23
Regulatory Requirements	4.08	1.38
Strategic Planning	3.15	0.97
Procedural Factors		
Education and Training	3.96	1.48
Financial Planning	2.73	1.31
Process Management	4.08	1.41
Program and Project Management	2.50	1.82
Risk Management	4.15	1.43
Service-Oriented Architecture (SOA)	1.08	1.38
Standards	0.73	1.56
Technology Change Management	3.58	1.55
Technical Factors		
Business Application Software	3.27	2.01
Cloud Computing Center of Excellence	2.88	1.68
Cloud-to-Cloud Hybrid Integration	0.92	1.70
Cloud-to-Non-Cloud Integration	1.15	1.71
Continuous Processing	0.77	1.45
Data	2.15	1.91
Elasticity of Processing Resources	0.62	1.44
Infrastructure Architecture	1.12	1.68
Multiple Cloud Service Providers (CSP)	0.35	1.23
Networking Implications	0.23	0.82
Platform of Cloud Service Provider (CSP)	0.23	0.71
Privacy and Security	2.69	2.31
Cloud System Problem Management	0.35	0.75
Tools and Utilities	1.19	1.86

What Influences Students to Use Dropbox?

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Abstract

The popularity of file hosting services is increasing as people are becoming more comfortable storing their files in the "cloud" versus on their local devices. Dropbox currently has over 50 million users and is one of the most popular file hosting services. Dropbox users save their files in a special folder on their computer or other device. These files can then be accessed through another computer or mobile device. No known study has examined the factors influencing students' decision to use the Dropbox file hosting service. This topic is important because end-users can choose among multiple competing file sharing services, many of which are offered for free or for a low cost. This study uses the 'Theory of Planned Behavior' and the construct 'Affect' to better understand student usage of Dropbox.

Keywords: Dropbox, Theory of Planned Behavior, Behavioral Intention, Affect

1. INTRODUCTION

The popularity of file hosting services is increasing as people are becoming more comfortable storing their files in the "cloud" versus on their local devices. Each year, people are creating more and more photos, images, documents, and other files that they need to access from multiple devices such as home PCs, work computers, smartphones, tablets, and other devices (Jesdanun, 2012).

Dropbox is one of the most popular file hosting services. It allows users to save their files in a special folder on their computer or other device. These files can then be accessed through another computer, smartphone, tablet, or similar device ("About Dropbox," 2012).
Multiple factors may influence an end-user's decision to use a file hosting service such as Dropbox. To date, no known study has examined the factors influencing students' decision to use the Dropbox file hosting service. This topic is important because end-users can choose among multiple competing file hosting services, many of which are offered for free or for a low cost.

This paper is organized into several sections, beginning with the Literature Review section, which provides background information about Dropbox and competing products. This section also includes the theory behind the paper, followed by the Hypotheses. The next section is Methodology, which describes the approach in collecting both interview and survey data for this study. In the findings section, the results from the correlation and hierarchical regression analyses are presented. Implications of the findings are provided in the discussion section, which is then followed by the conclusion section.

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2. LITERATURE REVIEW

Brief Overview of Dropbox

Dropbox was founded by MIT graduates Drew Houston and Arash Ferdowsi in June 2007 (About Dropbox, 2012). Houston came up with the idea after forgetting to bring his flash drive with him on multiple occasions (Ying, 2009). Dropbox was initially released to the general public in September 2008. The company has received over $250M in venture capital funding from investors including Accel Partners, Amidzad, Sequoia Capital, and Y Combinator (Crunchbase, 2012). The company's value is estimated at $5 to $10 billion (Lacy, 2011).

Dropbox has over 50 million users worldwide (Barret, 2011). About one-third of the users are from the United States, while the United Kingdom (6.7%) and Germany (6.5%) represent the next two largest user groups (Ying, 2010).

Dropbox can be accessed through multiple operating systems including Windows, Mac OS, and Linux, as well as mobile devices using Android, iOS, and the Blackberry OS. About two-thirds of Dropbox users use only Windows, while about 20% use only MacOS and 2% use only Linux. The remainder of Dropbox consumers use more than one operating system (Ying, 2010).

Dropbox's Business Model

Dropbox operates on the "Freemium" financial model – offering a free service with an option for users to upgrade (Gannes, 2010). Users of Dropbox can open a free account with 2GB storage. To gain more free storage space, users can refer new customers, earning 500MB of space per new referral up to 32GB of space ("Dropbox Referral Program", 2012).

In July 2012, Dropbox doubled the amount of storage space for paid users (Douglas, 2012). As shown in Table 1 (Dropbox Pricing, 2012), users paying in full for an entire year receive a discount over the monthly pricing.

Table 1: Fees for Dropbox storage space

Amount of Paid Storage Space	Monthly Cost	Yearly Cost
100GB	$9.99	$99.00
200GB	$19.99	$199.00
500GB	$49.99	$499.00

Dropbox's Competitors

In the backup client market, Microsoft's Backup and Restore holds 36.40% of the worldwide market share. Dropbox is the second most common backup product with 14.14% market share. Norton Online Backup (9.10%), Avira Premium Security Suite (6.87%), and Norton 360 (5.89%) lag Dropbox in the backup client market, as well as products from Acronis, Lenovo, Panda, and Paragon (OPSWAT, 2011).

Even though Google Drive, Microsoft SkyDrive, and other products do not fall into the backup client market according to OPSWAT, they also provide a way for users to back up their files through the cloud. Dropbox faces threats from these products as well as similar products from Amazon.com, Apple, and other companies (Jesdanun, 2012) such as Box.net, SugarSync, YouSendIt, and MediaFire.

Features of Dropbox

In addition to functioning as a storage service, Dropbox also offers sharing and synchronization features (Pash, 2008). It also supports revision history and allows deleted files to be recovered (Snell, 2009). In addition, Dropbox provides multi-user version control so that multiple users can edit files without overwriting versions (Snell, 2009). Dropbox also announced a feature in April 2012 to let users automatically upload their videos or photos from a mobile device, tablet, or SD card (Time, 2012). Dropbox has been praised by multiple publications for its ease of use and simple design (Dunn, 2008; Eisenberg, 2009; Mendelson, 2009).

Dropbox Privacy and Security Concerns

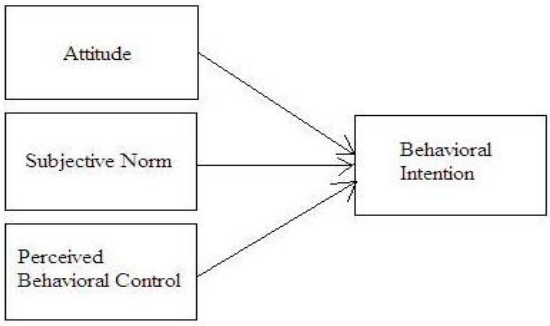
Some researchers have claimed that Dropbox's authentication architecture is insecure (Newton, 2011). Miguel de Icaza, a software expert, claims that Dropbox employees are able to access users' files (de Icaza, 2011). Also, in June 2011, a code update allowed all Dropbox accounts to be accessed without a password for a four hour period (Kincaid, 2011).
In short, there is a high level of trust between users and an organization responsible for providing cloud data storage services. If Dropbox were to fully disclose the details of how they secure customer data they would simultaneously increase the risk of exposing customer data to security breaches. This trust is an inherent problem for all organizations that

provide data storage through cloud computing services.

Theory of Planned Behavior

The Theory of Planned Behavior (Ajzen, 1991) can be used to examine the factors that influence a user's decision to use Dropbox. This theory uses three constructs to predict Behavioral Intention: Attitude towards the Behavior, Subjective Norms, and Perceived Behavioral Control. Behavioral Intention has been shown to be a strong predictor of actual behavior, which is difficult to measure in some domains. Attitude towards the behavior is defined as the degree to which a person has a favorable or unfavorable evaluation of the behavior in question (Ajzen, 1991). Attitude examines a person's beliefs concerning a behavior of interest. Subjective Norm refers to the person's perception of the social pressures to perform or not perform the behavior (Ajzen, 1991). Perceived Behavioral Control deals with the perceived ease or difficulty of performing the behavior (Ajzen, 1991). The Theory of Planned Behavior (TPB) expands a previous theory, the Theory of Reasoned Action (Fishbein and Ajzen, 1975), by including Perceived Behavioral Control as a third predictor of Behavioral Intention. The TPB is illustrated in Figure 1.

Figure 1: Theory of Planned Behavior (after Ajzen, 1991)



Ajzen (2001) has acknowledged that the TPB does not directly measure a person's feelings or emotions about a behavior of interest. Therefore, we have included an additional construct, Affect, as a fourth predictor of Behavioral Intention in order to determine whether feelings significantly influence the usage of Dropbox. We adopt the current preference for definition of 'affect' as "general moods (happiness, sadness) and specific emotions (fear, anger, envy), states that contain degrees of valence as well as arousal" (Ajzen & Fishbein 2000, Giner-Sorolla 1999, Schwarz & Clore 1996, Tesser & Martin 1996).

3. HYPOTHESES

Hypothesis 1: Attitude toward the Behavior is significantly and positively correlated with the intent to use Dropbox.

Hypothesis 2: Subjective Norm is significantly and positively correlated with the intent to use Dropbox.

Hypothesis 3: Perceived Behavioral Control is significantly and positively correlated with the intent to use Dropbox.

Hypothesis 4: Affect is significantly and positively correlated with the intent to use Dropbox.

4. METHODOLOGY

Both qualitative and quantitative approaches were used to capture data for this study. Undergraduates at a large southeastern university were recruited as participants for this study. First, ten volunteers were recruited to participate in short interviews. The purpose of the interviews was to solicit background information from students concerning their usage of Dropbox. These interviews were open-ended to allow students to elaborate on the reasons they may or may not use Dropbox or similar applications.

Data collected during the interview process were used to guide the construction of the survey instrument. The survey followed Ajzen's suggestions (Ajzen, 2001) for using the Theory of Planned Behavior. Survey items used to measure the 'Affect' construct were also included. Undergraduate business students enrolled during the 2012 summer session were asked to participate in the survey. While 196 students began the survey, 184 completed all questions.

The online survey was hosted by SurveyMonkey.com and the survey data were securely stored and downloaded from the SurveyMonkey.com web site. The data were then analyzed using the software programs Excel 2010 and SPSS 20.0. Tables 3 and 4 on the following page provide the results from the correlation analysis and hierarchical regression analysis.

Measures

Attitude

Attitude toward using Dropbox was directly measured using three statements. Participants were asked to indicate their level of agreement on a 7-point likert scale with each of the following statements:

(ATT1) Using Dropbox is a good idea.
(ATT2) Using Dropbox is a positive idea.
(ATT3) Using Dropbox is a helpful idea.

Subjective Norm

Three statements were also used to measure the construct of Subjective Norm. Again, participants were asked to indicate their level of agreement on a 7-point likert scale with each of the following statements:

(SN1) My professors influence me in my decision whether to use Dropbox.
(SN2) My friends influence me in my decision whether to use Dropbox.
(SN3) Other people important to me influence me in my decision whether to use Dropbox.

Perceived Behavioral Control

Three statements were used to measure Perceived Behavioral Control. Likewise, participants were asked to indicate their level of agreement on a 7-point likert scale with each of the following statements:

(PBC1) I have the ability to use Dropbox.
(PBC2) I possess enough knowledge to use Dropbox.
(PBC3) I have the resources to use Dropbox.

Affect

The additional construct 'Affect' was measured using three statements. Participants were asked to indicate their level of agreement on a 7-point likert scale with each of the following statements:

(AFF1) I would love/hate to use Dropbox.
(AFF2) I would be excited about/be bored using Dropbox.
(AFF3) I would be happy/unhappy using Dropbox.

Behavioral Intention

To measure behavioral intentions participants were asked to indicate, using a 7-point Likert scale, their level of agreement with the following three statements:

(BI1) I intend to use Dropbox in the next three months.
(BI2) I plan to use Dropbox in the next three months.
(BI3) I anticipate I will use Dropbox in the next three months.

Listed below in Table 2 are the results for Cronbach Alpha for each construct. Each construct is acceptable as the Cronbach Alpha is greater than .70 for each as recommended by Santos (1999).

Table 2: Cronbach Alpha for each Construct

Construct	Value
Attitude	.965*
Subjective Norm	.820*
Perceived Behavioral Control	.929*
Affect	.892*
Behavioral Intention	.957*

Demographics

As previously noted, undergraduates at a large southeastern university were recruited as participants for this study. A total of 196 participants (46.9% males and 53.1% females) began the research survey. A majority of the participants were business majors (25.5% Accounting, 13.3% Computer Information Systems, 5.1% Economics, 5.1% Entrepreneurship, 6.1% Finance and Banking, 4.1% Hospitality and Management, 6.1% International Business, 18.4% Management, 9.2% Marketing, 4.1% Risk Management and Insurance and each of the remaining majors represented approximately 3% of the sample).

Table 3: Class of Participants

Class	Percentage
Senior	55.1%
Junior	25.5%
Sophomore	11.2%
Freshman	8.2%

As shown in Table 3, slightly more than half of the respondents are seniors.

5. FINDINGS

Hierarchical regression was employed in this study because it allows for specification of the order of entry of the variables based upon theory and previous studies. This approach also allowed the authors to observe the change in R^2 as each independent variable was added into the model. Therefore, the researchers were able to determine whether or not additional variables were significant as they were entered into the equation.

Table 4: Correlation Matrix

	ATT	SN	PBC	AFF
BI	.511*	.424*	.434*	.594*
ATT		.272*	.652*	.749*
SN			.357*	.243*
PBC				.431*

ATT - Attitude; SN - Subjective Norm; PBC - Perceived Behavioral Control; AFF - Affect

* Correlation is significant at the 0.01 level

Table 5: Hierarchical Regression Analysis

Predictors (Constants)	R	Adjusted R^2	Sig. F Change
ATT	.511	.253	.000
ATT, SN	.591	.334	.001
ATT, SN, PBC	.594	.331	.469
ATT, SN, PBC, AFF	.671	.425	.000

(Dependent Variable = Behavioral Intention)
ATT - Attitude; SN - Subjective Norm; PBC - Perceived Behavioral Control; AFF – Affect

The Durbin-Watson test was used to identify any problem caused by autocorrelation. The results (d = 1.91) fell within the expected range of 1.5 – 2.5 (Tabachnick and Fidell, 2000).

Hypothesis 1 is supported. The correlation between Attitude and Behavioral Intention = +.511. Attitude was entered first into the hierarchical regression equation and explained 25.3% of the variance in Behavioral Intention. It is therefore concluded that Attitude is significantly and positively correlated with the intent of students to use Dropbox.

Hypothesis 2 is supported. The correlation between Subjective Norm and Behavioral Intention = +.424. Subjective Norm was entered second into the hierarchical regression equation and the total variance in intentions explained increased to 33.4%. Therefore, data indicates Subjective Norm is significantly and positively correlated with the intent of students to use Dropbox.

Hypothesis 3 is NOT supported. The correlation between Perceived Behavioral Control and Behavioral Intention = +.434. Perceived Behavioral Control was entered third into the hierarchical regression equation and the total variance in intentions explained did not increase. Therefore, the data indicates Perceived Behavioral Control is NOT significantly and positively correlated with the intent of students to use Dropbox.

Hypothesis 4 is supported. The correlation between Affect and Behavioral Intention is +.594. Affect was entered in last into the hierarchical regression equation and the total variance in Behavioral Intention explained increased to 42.5%. Therefore, the results indicate Affect is significantly and positively correlated with the intent of students to use Dropbox.

6. DISCUSSION

Considering the strong support in the Theory of Planned Behavior literature indicating a significant relationship between Perceived Behavioral Control and Behavioral Intention, it was initially surprising to note this significant relationship did not show up in this study. However, in Fishbein and Ajzen's (1975) earlier work their Theory of Reasoned Action included Attitude and Subjective Norm, while excluding Perceived Behavioral Control as a predictor of Behavioral Intention.

In this particular study, the results may also be an indication of a unique relationship between the Dropbox product and its users. In this study "affect" relates to an individual's emotional response towards Dropbox. Given (a) the inherent trust that must exist between Dropbox

and their customers, (b) the positive emotions associated with securely storing personal data with Dropbox versus the negative emotion of losing data during a computer failure, and (c) positive emotions of related to storing precious family momentos such as baby pictures and video of wedding; Perhaps things outside the volitional control of the user could be of lesser importance than a user's emotional response toward using Dropbox.

Through the use of interviews and results gathered from the survey, this study has provided a better understanding of the factors which influence students to use Dropbox. This is important for a number of reasons. First, this study indicates that Dropbox has a number of benefits for students. One of the interviewees stated, that Dropbox "...provides the convenience of having my files wherever I have Internet, not to mention the fact that you can use it on your phone."

Another student stated, "I started using Dropbox in the beginning of the Spring semester. I loved it. When I forgot to print out my homework from my computer at home, I was able to pull it up using DropBox. Your work stays with you at all times and can't lose it like when using a jump drive. Students who learn it as freshmen and are required to use it then, would definitely continue to use it throughout college. I know I will!" Several respondents implied that they were required by their professor to use Dropbox for a course.

This research could be extended to include other groups such as working professionals. Future research could also integrate other theories such as the Technology Acceptance Model or UTAUT. With a larger sample size, Structural Equation Modeling (SEM) could also be used to analyze the data.

7. CONCLUSION

Dropbox has quickly become one of the most popular file hosting services since its release in September 2008. This study discovered that two of the three predictors from the Theory of Planned Behavior (Attitude and Subjective Norm) are significantly and positively correlated with a person's intentions to use Dropbox. The results of our study suggest that Perceived Behavioral Control is not a significant predictor of Behavioral Intention in this domain. However, the findings indicate that Affect, a construct not measured in the Theory of Planned Behavior, significantly influences intention. Future research in this area should further examine the role of Affect since it was a significant predictor in this study.

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Demystifying the Fog: Cloud Computing from a Risk Management Perspective

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Abstract

Continual advances in technology and product differentiation have led to the dawn of cloud computing where virtually any computerized service – hard or soft – can be outsourced. Now that well-known companies such as Amazon and Google use their spare capacity and specific expertise for this purpose, all small business owners and IT managers must take its offerings into consideration. The potential benefits as well as the risks involved need to be weighed in light of the overall business strategy before deciding which services to engage. There are a great deal of services and applications available and choosing among them requires a multi-factor analysis. Because cloud computing is a young field and involves placing company assets under external control, there is significant risk involved. The manager or CIO must carefully select which aspects of his/r business model are amenable to roam in the cloud and use a variety of criteria to make a final decision. This paper examines an experimental approach to assessing whether organizations are ready for cloud computing.

Keywords: cloud computing, public cloud, software-as-a-service, and risk management

1. INTRODUCTION

Cloud computing continues to draw headlines and forecasts look impressive even in a sluggish economy. Investment is expected to increase to more than $120 billion by 2015. But should companies invest in it? And if so how much? Jumping right in could put businesses at risk, while waiting until it is completely safe could leave the organization playing catch-up with the competition (Loebbecke, 2012).

Officially, the National Institute of Standards and Technologies (NIST) has defined cloud computing as "a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction" (Mell & Grance, 2009, p.2).

In plain English, that means either offering or using computer hardware, software and/or

services over the internet. A cloud is an apt metaphor because the internet can be accessed from almost anywhere on earth today, even via a mobile phone. Storing e-mails on a Yahoo! server means you are using and relying on the cloud.

The NIST standards list the five characteristics of cloud computing as 1) On-demand self-service: server time and network storage are always automatically available; 2) Broad network access: computers can be reached through standard and mobile devices; 3) Resource pooling: storage, processing, network bandwidth, virtual machines and more can be assigned to many users simultaneously; 4) Rapid elasticity: capabilities can be quickly scaled up or down to satisfy demand; and 5) Measured service: services are optimized by metering out each service based on actual use (Mell & Grance, 2009)

The model that cloud service providers seem to be following is that of a utility company. Katzan (2010) labels the key characteristics as a) necessity: most of us consider computers and the internet to be necessary today; b) reliability: we expect water or electricity to be available 24/7; c) usability: getting on and off the cloud should be as easy as flipping a switch; and d) scalability: there should be ample resources available, yet users are only charged for actual consumption, and perhaps a small monthly fee. On the other hand, the cloud increases risk because you can be providing unauthorized access to private and proprietary information, which could possibly be mishandled or stolen.

One of the primary decisions a manager will have to make is what type of cloud to use. For this purpose, clouds can be classified into four types (Mell & Grange, 2009).

Private: This is operated for one organization only; it is the most secure and the most expensive. It can be hosted internally or externally, and can be managed either internally of by a third party. Géczy et al (2012) explain that a private cloud is on the organization's own premises and accessed via an intranet.

Public: This is owned and operated by the provider and available to the general public either for free (like Microsoft and Google's e-mail) or on a pay-per-use model. This is less secure than a private cloud, and depends on the levels of security provided by the service provider.

Community: This is shared by several organizations with a common purpose or requirements, thus the cost can be shared. It too can be managed and/or hosted internally or externally.

Hybrid: This is a combination of two of the above working together which share some data and applications. This type of cloud uses both on-site and off-site resources. It is more flexible for using applications, but there is a trade-off between more capacity and less security than with a strictly in-house system.

The four cloud types must be juxtaposed with three general layers of cloud services. The manager must decide which service(s) to use on which type of cloud(s).

Software as a service (SaaS): This is the most common service, whereby the customer uses the internet to access the provider's software hosted on the cloud at any time. A manager may choose to run any number of applications, including those for CRM, HRM, MIS, ERP or accounting.

Platform as a service (PaaS): the customer can use the cloud provider's infrastructure and tools to create and run its own software and applications; however, each provider has a limited set of tools and programming languages, such as Java and .NET. Companies can make their code available to others and lease unused infrastructure space this way.

Infrastructure as a service (IaaS): the processing, storage, networks, etc. are maintained by the cloud service provider, while the customer can choose and control the operating system and applications to run for its particular needs.

SaaS, PaaS and IaaS share several traits. They are all delivered over the web, and services can be accessed in the cloud on demand, usually via subscription fees or in a pay-as-you-go model. At any time, services can be upgraded or downgraded to accommodate current needs. This way they are expensed rather than capitalized.

2. ADVANTAGES

Switching from a traditional IT infrastructure to the cloud is like a manufacturing company changing from steam to electricity 100 years ago (McAfee, 2011). There are several reasons that organizations should consider the cloud.

The most popular reason given is usually cost. Rather than purchase hardware or software off the shelf, a new company can rent these services. This also reduces operating costs for maintaining equipment and paying IT personnel. In one extreme case, the IT manager at Coleman Data Services in Ohio reported his IT costs went from $2000 to $150 per month when he migrated to the cloud (McDaniel, personal communication). McAfee (2011) states that only 11% of a company's IT budget is spent on developing new applications. He suggests focusing on research and development to develop proprietary software, and that equipping employees to navigate the cloud would be a better use of resources (McAfee, 2011).

Another advantage of using the cloud is the provider may have useful software unknown to the customer. When Fairchild Semiconductors was not happy with its ERP package, it went to Workday and chose the standardized options Workday had developed by collaborating with 150 other companies. As users modify the configuration, Workday incorporates their best ideas or adds them as an option (Laudon & Laudon, 2012). The software is always up-to-date because providers are expected to have the most modern equipment. There is no need to constantly update and all members have the same version.

Key to the cloud-based model of IT is the integration of an organization's architecture. When Thomson and Reuters merged in 2008, they decided to use Salesforce instead of their own separate systems. By consolidating their data, they could share client account and other information at a lower cost (Iyer & Henderson, 2012).

Location independence is another advantage, especially for companies spread over a wide area or between countries. The Japanese corporation Fujitsu is in the process of having all 170,000 of its employees in 500 offices move to a private cloud where it can place all its files rather than having to upload them from an FTP server (Laudon & Laudon, 2012).

Businesses can increase worker output as well. Balfour Beatty decided to store company information on Box, allowing employees to access it while working overseas by using a web browser. This method also enabled personnel to manage their own accounts and apps without going through the IT department. This helped end users collaborate and share up-to-date information with both upstream and downstream partners (McAfee, 2011).

With Platform as a Service, users can create their own applications. Apple is the best example of this, offering tools for this purpose on its platform. When doctors at Rehabcare began using their iPads for patient screening, average wait time dropped from 18 hours to under 60 minutes (Iyer & Henderson, 2012).

Another benefit of cloud computing is that some clouds can blend into one another. Businesses can use different clouds for different aspects of their business, such as accounting, HR and production. The Small Business Web is a group of vendors forming an ecosystem of software applications that all customers can use. As long as the customers' APIs are open, they can share apps and information with others (Iyer & Henderson, 2012).

A final example is the San Francisco Bay area public transit authority, which moves 350,000 people/day. In 2009 it replaced its legacy system with Oracle's PeopleSoft applications running on HP servers with a Linux OS. In addition to providing more reliable service, its cloud is eco-friendly, using 20% less electricity (Laudon & Laudon, 2012).

3. DISADVANTAGES

The reason many companies are not jumping on the cloud is because of concerns over privacy, security and reliability. Ryan (2011) discusses the privacy issues that a conference chair must consider when using the cloud like EasyChair to host convention data. There are benefits and risks involved in leaving your data in the hands of others, but the open nature of the technology makes the system susceptible to bribery or coercion. He concludes that while a provider's reputation depends on its service, organizations cannot rely on people's sense of good behavior (Ryan, 2011).

Another major concern is reliability. In 2011 Amazon Web Services went down for three days in some places, causing a significant loss of revenue to many subscribers. When one organization is dependent upon another for critical services like internet access and data storage, then availability and system up-time requirements should be analyzed before migrating to cloud services. Another key element is to have an adequate backup system in place. Netflix developed its own redundant system when it adopted the Amazon cloud and

consequently suffered no loss during the blackout. In general, every organization experiences some downtime, and moving to the cloud does not significantly change this (McAfee, 2011).

Security is the third main issue facing cloud providers. How secure is the cloud? Who has access to your confidential and proprietary data? Does Toyota want its designs in the same network partition that Hyundai uses? While these concerns are legitimate, the same concerns would exist if the organization maintained its own IT infrastructure. All organizations are vulnerable to both internal and external attacks and should consider the appropriate access controls and security policies to ensure their data is secured. Hayes (2008) raises the issue of ownership. Can you take all your data and customized apps with you if you change providers? Can you delete records? And what happens if you can't pay your monthly bill?

4. RISK MANAGEMENT

In a more in-depth analysis, Iyer and Henderson (2012) name five business risks. First, there is a *falling demand* risk due to internal or external factors. This is especially fluid in the pay-per-use model of cloud computing. Second is *inefficiency risk* – companies with higher relative costs will lose out. Iyer and Henderson (2012) believe that outsourcing IT infrastructure and routine tasks makes a business more efficient, as in the case of Fairchild, which saved 15% in expenses and 50% in time when it used Workday. Third is *innovation risk* – the less innovative companies will falter. Even this can be outsourced, as when customers tap into Salesforces' continually expanding number of apps. Fourth is *scaling risk* – the risk that expansion for a new project will not pay off once it is finished. This is like the risk cities take when hosting an Olympics. Finally, *control risk* is the danger of inadequate internal controls to prevent and detect unauthorized access.

Iyer and Henderson (2010) then discuss seven ways that cloud computing mitigates these risks (Appendix 1). By "orchestrating dependencies" they mean a company's ability to match its dependence on various providers with the several needs of the company, such as using Salesforce for CRM. The "Facebook effect" refers to loyalty: designing features around user experience. Facebook carries out extensive testing before it launches a new feature, and then it analyzes user behavior to understand trends (Ivan & Henderson, 2010, p.54), thus anticipating demand.

The seven ways that cloud computing can add business value are:

1. Controlled interface: applications can be used by other services using an application program interface (API) – specifications used by software components to communicate.
2. Location independence: controls access to assets from anywhere within the enterprise
3. Sourcing independence: controls access to services and allows the company to change providers without penalty
4. Virtual business environment: integrated apps and tools that support business needs
5. Ubiquitous access: users' ability to access any service from any platform with a browser
6. Addressability and Traceability: the address of users and the usage of services can be tracked
7. Rapid elasticity: service usage can be scaled up or down automatically (Iyer & Henderson, 2010, p.56).

Ivan and Henderson (2010) indicate how these seven capabilities can control the five risks previously listed (Appendix 2). For example, demand risk can be dealt with by maximizing user access, tracking users and usage to look for causes, and either scaling up service to satisfy customers or scaling it down in order to minimize cost.

5. STRATEGY

Cloud computing greatly lowers the barriers to entry, not only due to lower hardware costs, but because software programs can eliminate the learning curve involved with each service area. Rhoton (2010) warns that it is important to get the right provider because the costs of changing clouds can be high due to incompatible programs or operating systems.

The bargaining power of customers is also increasing as the number of providers and users increases, bringing down prices. The threat of substitutes exists with the constant entry of more providers, who continuously offer more services and new applications. Companies should be very happy with their own apps before they choose to ignore the growing menu on tap in cyberspace.

Rhoton (2010) recommends a focus on product differentiation and believes that cloud computing makes a company more agile. Because

information is more widely available due to global networks, the time from when a new product is designed to when it gets to market needs to be accelerated. Even then the advantage is only temporary; consequently, companies should keep focused on their core competencies of creating new products.

Ultimately, outsourcing cloud services (or "cloudsourcing") can allow a business to change its entire strategy. If internal IT resources are a weakness, it can soon become a strength as the field trends toward XaaS – everything as a service (Rhoton, 2010).

6. SELECTION

If cloud technology is the revolutionary technology many claim, a company must take measures to minimize the risk to its mission and strategy to achieve its goals. Management needs to take an inventory of its business processes and decide which ones can be safely outsourced without losing control over its core competencies. There will also be financial repercussions with changes in cash flow and the shift from capital to operating expenses.

Making financial calculations related to the change to cloud computing is very difficult because it's a new field and the effects are hard to gauge. There is not yet enough data to calculate a discount rate for risk or a standard deviation for variability. Because cloud computing is considered risky at present, banks may charge a higher interest rate than for other projects. Finance managers should take this into account when making scenario analyses for risk and return decisions.

Rhoton (2010) provides a list of the components of an extant IT system which should be compared with the costs of the cloud option, including hardware, network infrastructure and connectivity, software, security, support, operations, service, and contract management. Normally, procurement may only be 25% of the total cost of IT investments. There are also capital costs – installation and maintenance; transition costs – training users and integrating the legacy system with the cloud; and operating costs such as support, overhead, and any license or usage fees.

Most businesses do not want to put everything on the cloud at once. It is advisable to first make an inventory of the software applications in stock and decide which ones are safe and less expensive to put on the cloud. There are many technical considerations which IT personnel should be consulted on, such as the degree of customization needed to interact with the cloud (Rhoton, 2010).

Any new IT projects undertaken by a company involve a number of rent vs. buy decisions. Much depends on the available expertise in the IT department. Unless control over private data is a paramount concern, it may be cheaper to cloudsource many services than to hire new personnel. With so many cloud services offered, most IT personnel need only be concerned with maintenance and security.

Software as a service is the most common use of the cloud. Many services are prefabricated like the web pages hosted by Yahoo. They can be customized for a price, which may be necessary to differentiate a brand. The interaction with the customer is very important and must be monitored closely at the outset.

Infrastructure as a service is the most flexible offering. The company can choose among hardware and network facilities, or separate components of these, such as CPU time. The amount of storage and bandwidth needed can also be priced. Another advantage of cloudsourcing is that many costs are itemized without having to calculate overhead.

Platform as a service is the least developed to date. This includes many tools for application design and development. If the platform is multi-tenant, the number of programming languages and interfaces are strictly limited in order to protect the other tenants. Géczy et al (2012) says this is necessary for small companies that need to integrate with third-party systems or large-scale testing. There is a risk of vendor lock-in whereby material must be left behind when the contract is terminated. One must also check for backward compatibility – that versions do not become incompatible when the platform updates (Rhoton, 2010).

The choice of provider is obviously extremely important. There is an abundance of cloud providers today, but many of them new and unproven. Public companies are considered more reliable since they must publicize information about how they store data and what security measures are in place. Companies may also state whether they follow audit standards like SAS 70, or have ISO or NIST certificates. Rhoton (2010) gives four criteria to take into consideration:

Environment – encompasses the location of the building and its power supply, HVAC and security.

Technical – the amount of capacity and bandwidth available, as well as security concerns such as tenant isolation and a separate encryption key for each business.

Contractual – how usage is measured and billing is determined. The terms of service should specify how the provider will handle incidents such as DoS or hack attacks and viruses. The provider may not want to make these public, but a company needs to know about all of these.

Financial – The status of the company as an on-going concern is quite relevant for a long-term contract. Consult Moody's and other credit raters, and again, public companies are more forthcoming with financial statements and debt level.

Balanced scorecard

A company's balanced scorecard may also be consulted before making the jump to the cloud. This is a group of performance measures intended to evaluate the company vision and strategy. Each item should be noted such that judgments can be made about whether the company is improving. If no scorecard exists, one could be created for the questions raised during deliberation. The Balanced Scorecard (BSC) normally has four perspectives, Internal Business Processes, Learning and Growth, Financial, and Customer (Kaplan & Norton, 1996). Cloud computing could fit as an initiative within each of the four dimensions of the BSC. However, it would be helpful to have a control group not affected by the cloud implementation for comparative purposes.

The most important element is the customer. Placing that client's data and business in the hands of another entity does not diminish any responsibilities of the primary data owner. Customer satisfaction can still be measured by surveys and indicators such as the number of complaints, new customers, and retention rate.

There will be many factors to evaluate in the operations section of the scorecard. The primary factor is the sales numbers, but other factors include response time in the customer service center and throughput time in internal business processes such as manufacturing, processing, and logistics. Learning and growth and human resources will also be affected, so training and value-added performance need to be measured to avoid under or over-staffing.

7. IMPLEMENTATION

Considering the risks involved, managers must plan carefully before moving some of their business processes to the cloud. Iyer and Henderson (2012) recommend short-term experiments. New technologies should be matched with internal needs. Using the scientific approach, a business unit can formulate a hypothesis and assess the outcome of the experiment.

On less expensive public clouds like Amazon, there is very little support. Potential users need to join online user groups where they can find out what the common problems are, share knowledge, and get answers to FAQs. If moving to the cloud gradually, a competent IT team is needed to maintain compatibility between the legacy systems and new architecture.

Decision-makers must also consult with their upstream and downstream partners to understand their plans for the future. The clouds are not all interchangeable, so compatibility could become an issue.

McAfee (2011) also recommends an experimental approach. CIOs first need to meet with their counsels and compliance experts to understand any restrictions on sharing confidential and private data. Infrastructure-as-a-service is mature now and new development projects are a good fit for the cloud. The hardware and software are all ready to plug in and play, so more time can be spent writing proprietary code. Google Maps is one well-known application. One energy company in Queensland used this to map its 150,000 km. of power lines in order to make better environmental impact and risk management decisions (McAfee, 2011).

8. CONCLUSION

Although financial analysts will have their work cut out for them when deciding whether to include a shift to the clouds in the budget, cost is only one of many important factors to weigh. While security and reliability concerns have kept many from taking the leap, risk management also includes the business risks that exist when a company does not keep up with the competition.

Cloudsourcing can be ideal for smaller companies with limited capital and funds to invest in IT infrastructure, or limited human resources with IT expertise to run an in-house platform. There are also many routine IT operations for a medium or large company to outsource, such as accounting entries, data entry, and logistics.

In reality, cloud computing is nothing mysterious and should be seen as a potential way for organizations to do business. It has become almost as common as the internet that ties people to e-mail and e-commerce. Any company that relies heavily on IT for sales or analytics needs to prepare for the day when nearly all services may be provided inexpensively through the cloud by companies such as Amazon and Google. The best strategy for most organizations will be to begin their cloud implementation one incremental step at a time.

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APPENDIX 1

Table 1. Benefit Patterns and the Business Risks They Help Mitigate

	Business Risks				
Business Benefits	Demand	Inefficiency	Innovation	Scaling	Control
Increased business focus			√		
Reusable infrastructure	√	√		√	√
Collective problem solving		√		√	√
Business model experimentation	√		√		
Orchestrating dependencies	√	√			
Facebook effect	√				

Iyer & Henderson, MIS Quarterly Executive, 2012, Vol. 11 Issue 1, p.55

APPENDIX 2

Table 2. How Cloud Computing Capabilities Can Mitigate Business Risks

	Business Risks				
Cloud Computing Capabilities	Demand	Inefficiency	Innovation	Scaling	Control
Controlled Interface			√		√
Location independence		√			
Sourcing independence		√		√	
Virtual business environment		√	√		
Ubiquitous access	√	√	√		
Addressability and traceability	√		√		√
Rapid elasticity	√			√	

Iyer & Henderson, MIS Quarterly Executive, 2012, Vol. 11 Issue 1, p.57