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JOURNAL OF INFORMATION SYSTEMS APPLIED RESEARCH

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A Study of Information Technology Operating and Capital Expenditures and Their Effect on Positive Firm Outcomes

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Abstract

For many years, business has invested significant resources in information technology, hardware, software, and manpower. The Productivity Paradox is the seeming lack of productivity gains despite the increased investment in IT (information technology). For many decades the existence of a Productivity Paradox has been the subject of research interest. Conflicting results have been obtained from a variety of data sets. Until this study however there has been no study that has specifically reviewed operating and capital information technology expenditures and their impact on positive firm outcomes. The objective of this study was to investigate information technology productivity with a new data set and measure both information technology capital and operating expenditures to determine whether increased expenditures had a significant impact on how a firm viewed their IT quality as measured by improved decision making, data integrity, and data consistency. Results of the study indicated that changes in levels of information technology expenditures as a percent of revenues did not have a consistent positive impact on firm level productivity in this large sample of firms. The Productivity Paradox does seem to continue and sheer increase of expenditures does not directly result in improved firm outcomes. The major contribution of the study is that it provides an analysis of the impact of information technology expenditures on perceived firm IT quality.

Keywords: productivity paradox, capital expenditures, operating expenses, information technology

1. INTRODUCTION

Since 1987, many researchers such as Erik Brynjolfsson, Paul Strassman, and Loren Hitt have studied the problem of whether the huge investment in information technology (IT) has had a positive impact on overall productivity in the economy and specifically on the firm. A variety of data sources has been analyzed across different perspectives and researchers have come to different conclusions on this central question.

The Productivity Paradox concept started in 1987 with Robert Solow, the Nobel prize-winning economist, who said that computers can be seen everywhere but in the productivity statistics (Solow, 1987). The Paradox as presented by Strassmann is that, despite large investments in information technology, productivity as measured by cost of goods sold has not increased (McCune, 1998). Loveman, in 1988, studied information technology capital versus output over a five-year period, and found no correlation between information technology spending and output increase (Brynjolfsson, 1993). The Productivity Paradox simply stated that empirical investigations in the late 1980s and early 1990s seemed to show that information technology investments, by a variety

of measures, were not contributing to overall productivity gains. Since the late 1980s, however, a series of studies have provided different, more positive results for information technology investments. The studies have included Brynjolfsson and Hitt (1996), Bharadwaj, Bharadwaj, and Knosynski (1999).

More recent studies in the 2000's continue the debate on the effect of information technology on firm performance. Lapointe, L., Mignerat, M., & Vedel, I. (2011) studied the increased expenditures in the health industry and found that despite these large expenditures health services productivity may not be keeping pace, suggesting a possible Health IT Productivity Paradox. Liu, T. K., Chen, J. R., Huang, C. J., & Yang, C. H. (2013) found a significant positive impact on information technology expenditures and labor productivity in a study they performed in Taiwan. Tambe and Hitt (2012) suggest conflicting results in how and whether information technology expenditures increase productivity. They saw differences in results based on company size, type of industry, and in time of improvement realization. The end result of recent studies is that they generally have the same results as classic past studies; no clear conclusion can be drawn as to whether IT expenditures increase productivity or to what extent they may affect productivity,

2. RELEVANCE OF THE STUDY

The general question addressed in this research is similar to many previous studies, i.e., does investment in information technology have a significant positive effect on overall firm productivity and performance. This work, however, adds to the literature in several ways:
1. This empirical study analyzes both operating and capital information technology expenditures.
2. This research examines current information.
3. It includes a large sample of organizations with varying sizes and industries.
4. It examines performance via three quality variables.
The work is an extension of the authors' past works on this critical issue (self-references to be added).

3. BARRIERS AND ISSUES

As with any empirical research, the biggest challenge was to find an appropriate data source to empirically investigate the proposed research problem. The first step in obtaining a data set was to review the data sets used by other researchers in the field. The data sources for the studies presented in the literature search vary from government sources to major publications' survey data, to private empirical surveys. A data set heretofore unanalyzed was the Financial Executives' Institute Annual Survey of Technology Issues for Financial Executives. The survey is a major analysis of company views on IT and includes relevant questions to address our study.

4. AREA TO BE INVESTIGATED

Many of the major studies that have been performed are at this point decades old. But the issue of whether or not there is a productivity paradox has never been resolved. This work is an attempt to revisit this area of study using current broad based data analysis. This study empirically investigates the following research proposal: Positive firm outcomes are recognized for firms that have a higher investment in information technology. In other words IT adds to productivity and there is no Productivity Paradox.

5. SIGNIFICANCE OF THE STUDY

This study represents a significant research issue due to the sheer size of information technology spending in the economy as a whole, and its expected positive impact on firms. The significance of the study is that 32.5% of all business capital investment is IT related, not including software and systems development. (Dos Santos, Peffers, and Mauer, 1993) This is a very significant expenditure for business. It should be determined whether IT increases firm outcomes. The study of the productivity impact of information technology on organizations started slowly. Though commercial applications for computer technology started in the late 1950s and accelerated through the 1960s and 1970s, there was little research on measuring the benefits gained from information technology spending. The implementation of management information systems and related technology were accepted in organizations through the perceived savings in manpower gained from automating clerical tasks such as payroll, accounts payable, and other financial applications. But beginning in the early 1980s, researchers tried to measure the impact that IT was having on the individual firm, in specific applications, and on the economy as a whole. No significant studies focusing on IT productivity were developed until the early 1980s. Then the pace of studies significantly accelerated and reached its peak in the period 1987-1995. Results from two decades of studies have

resulted in little consensus on whether IT spending is having a significant favorable impact on individual firms or the economy as a whole.

6. SURVEY SOURCE AND METHODOLOGY

In order to test these hypotheses, specific corporate data were required. We found a data set that was available from Financial Executives International. Financial Executives International is "the preeminent association for CFOs and other senior finance executives." It has … CFOs, VPs of Finance, Treasurers, Controllers, Tax Executives, Academics, Audit Committee members [in] companies large and small, public and private, cross-industry (FEI, 2010). The FEI, each year, commissions a large scale study of "technology issues for Financial Executives." Thel survey instructions follow.
"FEI's Committee on Finance & Information Technology (CFIT) and Financial Executives Research Foundation (FERF), in partnership with Gartner, are conducting the twelfth annual survey of Technology Issues for Financial Executives. This research examines and reports on information technology from the perspective of the financial executive." (FEI, 2010).
According to FEI (2010) "The 2010 Gartner-CFIT-FERF Technology Survey captured 482 senior financial executives' views of technology—double the responses compared to 2009. The study provides a consistent picture of the CFO's view of technology and offers an important opportunity for you to benchmark your internal initiatives and perspectives with those of other finance organizations."

As a part of this study, specific information was obtained from top financial executives on systems quality and expenditures. These questions and responses were sufficiently detailed and pertinent to our hypotheses to serve as the bases for testing this study's hypotheses. The main advantage is the large data set and the independent collection from a private membership trade group. All data has been collected and furnished by the Financial Executives International and remains their property. Use for academic and research purposes was obtained by the author. The author wishes to sincerely thank the organizations for their cooperation.
The overall questionnaire included 44 questions in the noted categories but sub-questions and ranked responses raised the overall individual data points to more than 220. From this overall report a small subsection was used to analyze the relevant hypotheses. Selected responses from the Demographics section were included as well. The specific questions used to test the hypotheses are listed.
(FEI, 2010)

The use of rich secondary sources for scholarly research is well established across social sciences. Some studies that primarily or exclusively use secondary data are found in management (Sanhu & Kapoor, 2010), government (Siau & Long, 2009) supply chain (Thakkar, Kanda, & Deshmukh, 2009), accounting (Talha, Raja, & Seetharaman, 2010), marketing (Panigyrakis, Kapareliotis, & Ventoura, 2009), medical (Broyles, Chou, Mattachione, & Al-Assaf, 2010), economics (Gouvea & Kassicieh, 2009), and education (Martelli & Abels, 2010).

General Linear Model (GLM) Univariate analysis was used for test the hypotheses. SPSS 20.0 was used for all statistical analyses. The dependent variable was the positive outcome variable and the independent variables were IT expenditures and Demographic data.

7. DEMOGRAPHICS OF PARTICIPANTS

Overall, in the survey there were approximately 483 usable responses from corporations (depending on the question). The demographics of the group follow.

Nearly 83% of the respondents were from the Corporate. The sample reflects the strong executive position that most of the respondents held. This study thus reflects top executive views on the related technology. The remaining participants were at the Group or Division/Unit level. Table 1 reflects the size distribution of the organizations. In general, the organizations are large with 56% over $100 million in sales. The largest respondents were in the less than $100 million sales category but there were still 126 respondents with sales greater than $1 billion.

8. QUESTIONS

As noted, a small subset of the questions in the survey was used to explore our research question. The specific questions used were:

6a. What is your company's IT operating expenses (not including depreciation) as a percentage of revenue?
Example: 3 percent entered as 3.0

6b. What is your company's IT capital expenditure as a percentage of revenue?
Example: 3 percent entered as 3.0

2a. How would you grade the relative maturity of your management information environment in terms of its ability to readily provide relevant analyses, decision making and management reporting information?
(please specify)
Exceptional, Superior, Average, Poor, Failing
2b. Please indicate how consistent is the management and financial reporting delivered by the finance team with other operational reporting performed by line of business managers:
Highly consistent – there is never any disagreement over numbers on management meetings
Quite consistent – there are minor differences between operational reports and finance data
Somewhat consistent – the high level numbers agree (often due to manual reconciliation) but we find it hard to explain variances in finance data with data form operational systems
Inconsistent – we spend a lot of time in management meetings arguing over whose numbers are right.

9a. What is your overall level of satisfaction with your organization's "information integrity", defined as accuracy, consistency and reliability of information?
Highly satisfied, Somewhat satisfied, Neutral, Somewhat dissatisfied, Highly dissatisfied

9. HYPOTHESES

With the secondary dataset and the available questions, we were able to develop two hypotheses to explore if increases in information technology expenditures provide positive firm outcomes.

Hypothesis 1 Investment in IT operating expenses as a percent of revenues will improve firm information maturity, information integrity, and/or information consistency

Hypothesis 2 Investment in IT capital expenditures as a percent of revenues will improve firm information maturity, information integrity, and/or information consistency

10. RESULTS

The first hypothesis was that investment in IT operating expense as a percent of revenues would result in positive firm outcomes. The second asked the same question based on IT capital expenses. Specifically, GLM Univariate analyses were performed with three separate positive outcomes for a firm, Maturity (ability to readily provide relevant analyses, decision making and management reporting information), Consistency (how consistent is the management and financial reporting delivered by the finance team with other operational reporting performed by line of business managers), and Integrity (accuracy, consistency and reliability of information). These GLM analyses were repeated twice, once including company size as a separate independent variable and second using industry as a separate independent variable. Tables 2 thru 7 show the significance of these variables as well as interaction effects of size or industry and IT Op expense and IT Cap expense. Table 2 shows that neither changes in IT Operating expense nor changes in IT Capital expenditures had a significant influence on Maturity as the dependent variable. There was also no interaction effect between size and IT Operating or Capital Expenses. From this first analysis we can conclude that there does appear to be a productivity paradox across all sizes of organizations regardless of size. Companies that spent more on IT either in capital or operating expenses did not enjoy higher ability to provide relevant analysis, decision making or management reporting. Table 3 presents a similar analysis for information consistency. Though significance levels are generally improved, there was found no significant direct or interaction impact from IT Operating expense or IT capital expenses. This again found to be the case across all sizes of organizations. Table 4 finally examines integrity of information and finds no significant direct or interaction impact from changes in IT Operating Expense or IT Capital expense.

In tables 4 to 7 we perform the same GLM analyses using Maturity, Consistency, and Integrity and finds no significant direct or interaction impact.

For all variables, there was no significant influence on any of the positive dependent variables. Hypotheses 1 and 2 cannot be supported. Firms that had a higher percentage of IT operating or capital expenditures did not experience improved Information Maturity, Information Consistency, or Information Integrity. And this did not vary based on either industry size nor industry type. There were also no significant interaction effects as well. This is illustrated in the tables 2-7 by examining the significance of the variables or the interactions. None were $p < .05$.

11. CONCLUSIONS AND IMPLICATIONS

The overall objective of the study was to determine whether a Productivity Paradox still existed and currently exists at the firm level for major organizations. In other words, the question was whether information technology had a positive impact on positive firm effects. The results of the study generally found no positive relationship between IT spending as a percent of revenue and firm level positive outcomes, Information Maturity, Information Consistency, and Information Integrity. Based on these measures a Productivity Paradox at the firm level was observed in this study.

12. ANTICIPATED BENEFITS

The implications of the findings may influence corporate spending on information technology in both operating and capital areas, since information technology expenditures generally did not add positive outcomes of the firm. Other variables also come into play to create positive outcomes for a firm. This suggests that not all IT expenditures are successful or add value to a firm. Care must be taken with IT expenditures. This study advances knowledge of the impact of information technology spending.

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Tables

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than $100 Million	211	43.7	43.8	43.8
	$100 Million – $499 Million	111	23.0	23.0	66.8
	$500 Million – $999 Million	34	7.0	7.1	73.9
	$1 Billion – $5 Billion	64	13.3	13.3	87.1
	Greater than $5 Billion	62	12.8	12.9	100.0
	Total	482	99.8	100.0	
Missing	System	1	.2		
Total		483	100.0		

Table 1 Company Sizes

Dependent Variable: Maturity

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	44.413[a]	105	.423	.706	.978
Intercept	447.575	1	447.575	747.095	.000
Size	1.133	4	.283	.473	.756
ITOpExp	4.811	14	.344	.574	.884
ITCapEx	7.043	10	.704	1.176	.308
Size * ITOpExp	7.362	19	.387	.647	.867
Size * ITCapEx	5.498	13	.423	.706	.757
ITOpExp * ITCapEx	9.181	23	.399	.666	.876
Size * ITOpExp * ITCapEx	3.799	9	.422	.705	.704
Error	135.394	226	.599		
Total	3120.000	332			
Corrected Total	179.807	331			

a. R Squared = .247 (Adjusted R Squared = -.103)

Table 2 Maturity and Size Analysis

Dependent Variable: Consistency

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	65.181[a]	105	.621	1.157	.184
Intercept	216.542	1	216.542	403.656	.000
Size	1.811	4	.453	.844	.499
ITOpExp	10.630	14	.759	1.415	.147
ITCapEx	8.620	10	.862	1.607	.106
Size * ITOpExp	10.351	19	.545	1.016	.444
Size * ITCapEx	9.325	13	.717	1.337	.193
ITOpExp * ITCapEx	6.583	23	.286	.534	.962
Size * ITOpExp * ITCapEx	6.404	9	.712	1.326	.224
Error	121.238	226	.536		
Total	1675.000	332			
Corrected Total	186.419	331			

a. R Squared = .350 (Adjusted R Squared = .047)

Table 3 Consistency and Size Analysis

Dependent Variable: Integrity

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	134.366[a]	105	1.280	1.057	.362
Intercept	253.717	1	253.717	209.599	.000
Size	3.455	4	.864	.714	.583
ITOpExp	16.680	14	1.191	.984	.470
ITCapEx	10.442	10	1.044	.863	.569
Size * ITOpExp	20.417	19	1.075	.888	.599
Size * ITCapEx	21.213	13	1.632	1.348	.187
ITOpExp * ITCapEx	22.489	23	.978	.808	.720
Size * ITOpExp * ITCapEx	13.828	9	1.536	1.269	.255
Error	273.571	226	1.210		
Total	2283.000	332			
Corrected Total	407.937	331			

a. R Squared = .329 (Adjusted R Squared = .018)

Table 4 Integrity and Size Analysis

Dependent Variable: Maturity

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	100.573[a]	199	.505	.842	.864
Intercept	485.800	1	485.800	809.318	.000
ITOpExp	4.656	11	.423	.705	.732
ITCapEx	3.940	10	.394	.656	.763
Industry	15.050	30	.502	.836	.710
ITOpExp * ITCapEx	5.824	9	.647	1.078	.383
ITOpExp * Industry	29.330	44	.667	1.111	.319
ITCapEx * Industry	16.968	32	.530	.883	.648
ITOpExp * ITCapEx * Industry	1.828	7	.261	.435	.879
Error	79.234	132	.600		
Total	3120.000	332			
Corrected Total	179.807	331			

a. R Squared = .559 (Adjusted R Squared = -.105)

Table 5 Maturity and Industry Analysis

Tests of Between-Subjects Effects

Dependent Variable: Consistency

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	112.696[a]	199	.566	1.014	.469
Intercept	221.341	1	221.341	396.312	.000
ITOpExp	7.506	11	.682	1.222	.279
ITCapEx	7.794	10	.779	1.396	.189
Industry	14.976	30	.499	.894	.628
ITOpExp * ITCapEx	4.481	9	.498	.891	.535
ITOpExp * Industry	23.465	44	.533	.955	.558
ITCapEx * Industry	22.728	32	.710	1.272	.174
ITOpExp * ITCapEx * Industry	2.185	7	.312	.559	.788
Error	73.722	132	.559		
Total	1675.000	332			
Corrected Total	186.419	331			

a. R Squared = .605 (Adjusted R Squared = .008)

Table 6 Consistency and Industry Analysis

Tests of Between-Subjects Effects

Dependent Variable: Integrity

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	239.668[a]	199	1.204	.945	.644
Intercept	293.040	1	293.040	229.877	.000
ITOpExp	12.638	11	1.149	.901	.541
ITCapEx	16.195	10	1.619	1.270	.254
Industry	38.289	30	1.276	1.001	.474
ITOpExp * ITCapEx	6.377	9	.709	.556	.831
ITOpExp * Industry	39.707	44	.902	.708	.906
ITCapEx * Industry	35.050	32	1.095	.859	.683
ITOpExp * ITCapEx * Industry	6.663	7	.952	.747	.633
Error	168.269	132	1.275		
Total	2283.000	332			
Corrected Total	407.937	331			

a. R Squared = .588 (Adjusted R Squared = -.034)

Table 7 Integrity and Industry Analysis

A Study of Cloud Computing Infrastructure-as-a-Service (IaaS) in Financial Firms

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Abstract

The cloud continues to be a delivery method of information systems deployed frequently by financial firms. Infrastructure-as-a-Service (IaaS) is an evolving model of this method in industry. In this study, the authors evaluate critical few factors that can enable financial firms to formulate a generic strategy from investment in IaaS. The authors find procedural factors more evident than technical and business factors on projects of IaaS, but also find implementation methods more limiting in strategy. The findings of this study contribute a framework for investment in this maturing method of cloud computing.

Keywords: cloud, cloud computing, cloud deployment models, financial industry, information systems, infrastructure-as-a-service (IaaS), strategy

1. DEFINITIONS OF CLOUD COMPUTING AND INFRASTRUCTURE-AS-A-SERVICE (IaaS)

The cloud is defined in the literature as "a [method]:

enabling convenient, on-demand network access[by a business 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" (National Institute of Standards and Technology [NIST], 2009).

Business firms benefit from the cloud in elasticity and flexibility in the dynamic scalability of services and especially from hardware procurement and productivity by renting technology; and firms benefit from consolidating data centers into fewer servers from multiple physical servers, having overhead savings

(Kulkarni, Sutar, and Gambhir, 2012) benefiting especially financial firms. The cloud is evident in services of technology in almost all firms inIndustry (Black, Mandelbaum, Grover, and Marvi, 2010). The cost of investment in the cloud is declining and driving its force as a justified proposition to firms (Koulopoulos, 2012). The cloud computing method is considered a business evolution (Hossain, 2013), but is also defined as a "disruptive" (Messmer, 2013), "dominant" (Luftman, 2011) and essentially "exponential element" in impact (Koulopoulos, 2012) in industry, if not "the most significant technique in the 21st century" (Prasanth, 2012).

The Infrastructure-as-a-Service (IaaS) is defined in the literature as a data center-as-a-service model (Linthicum, 2009):

enabling "the capability … [for a business firm for] provision[ing] fundamental computing …, network[ing], processing and storage, where the [business firm] is able to deploy and [operate] arbitrary software, which can include applications and operating systems… the [firm] does not control or manage the underlying cloud infrastructure but … controls deployed applications, … limited control of … networking …, operating systems, and storage" (National Institute of Standards and Technologies, 2010) – a virtual data center (Gartner Report, 2012) for financial firms and an infrastructure for cloud computing Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS) in industry (Hossain, 2013).

2. INTRODUCTION TO STUDY OF FINANCIAL FIRMS AND IaaS

Despite the benefits, firms in general are cautious about the cloud because of difficulties cited in the literature (Sunyaev and Schneider, 2013). Firms doing projects may not have a framework for the implications of cloud systems in contrast to non-cloud systems (Alvarez, 2012, and Leavitt, 2009). For financial firms, data processing regulatory requirements and restrictions, and data privacy protection and security (Cronin, Pauli, and Ham, 2012), may be an issue on IaaS systems (Hay, Nance, and Bishop, 2011 and Pal, 2013); and international privacy requirements may be an issue on shared systems. Interruptions in provider service (Perkins, 2013) may be an issue (Sunyaev and Schneider, 2013) on IaaS systems. Providers managing the infrastructures may limit responsibilities for their services and limit the rights of the firms (Baldwin, 2012). Savings may not be realized by the firms (Violino, 2011). Though firms benefit from the cloud, they are fearful of the risks (F5 Networks, 2009). They have to be cautious about investment in cloud models (Ditmore, 2013) of outsourced services and frequently limit investment to hybrid (private and public) or private cloud IaaS models (Forrester Report, 2011) on non-critical systems. The hesitation in implementation of the cloud computing method may limit investment in this paradigm of technology.

Estimates however are clear that firms are engaged in the cloud, including IaaS (Krigsman, 2012). Firms have had an investment of $110.3 billion in the cloud in 2012 (Gartner Forecast Overview Report, 2013), and the investment is forecasted to be $206.6 billion in 2016 (Gartner Report, 2012). Estimates forecast a further 62% of processing, or 4.3 zettabytes, to be in the cloud in 2016 (Pushp, 2012). Financial firms have increased investment in the cloud (MacSweeney, 2013), as 23% have aggressively initiated projects, and 43% have modestly initiated them, in 2013 (Honore, 2013). Financial firms have increased investment on IaaS projects, as 42% have initiated hybrid (private and public) systems, and 38% have initiated private systems, as early as 2011 (Forrester Report, 2011). The IaaS investments have involved production systems. Though financial firms have initiated investment in cloud systems in a frequency higher than might be expected from the issues (Kondo, 2011), the literature indicates that they may not have a framework for the implications of IaaS systems (Alvarez, 2012 and Leavitt, 2009). The lack of planning projects in a strategy may be a problem, as the firms proceed on the systems (Forrester Report, 2011).

In this study, the authors conduct an evaluation of cloud factors on IaaS projects that may enable financial firms to formulate an evident generic strategy for IaaS systems. Evaluation of IaaS is important in the field, as financial firms have diverse options from a growing number of providers (Babcock, 2012 and Babcock, 2013) pushing solutions that may not be proper to the requirements of the firms (Linthicum, 2012a). Financial firms having a holistic IaaS requirements and roadmap strategy (Sharma, 2012) – not an easy initiative (HP Report, 2013) – may improve the performance and security of their IaaS systems and technologies (Gubala

and Sprague, 2011). How are financial firms engaging in IaaS projects initiating or not initiating a strategy? How are financial firms integrating or not integrating private and public IaaS services, including information protection services, on production systems in a strategy? How are financial firms focusing or not focusing on internal implications of IaaS projects and systems? Neither practitioner nor scholarly literature furnishes a full framework (Rimal, Choi, and Lumb, 2009) for a generic IaaS strategy. Therefore, this study furnishes a factor framework for a methodology for an IaaS cloud computing strategy in the financial industry.

3.0 CLOUD FACTOR FRAMEWORK in IaaS STRATEGY – MODEL OF STUDY

The critical few factors for enabling financial firms engaging in investment on projects in an IaaS strategy are defined in business, procedural and technical categories. These factors are founded and justified from earlier models of the authors on cloud computing strategy (Lawler, Howell-Barber, Yalamanchi, and Joseph, 2011 and Howell-Barber, Lawler, Desai, and Joseph, 2012), from which they evaluated IaaS, Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS) broadly and SaaS individually in industry. The definitions of these factors are created by the authors and customized by them to IaaS. This study expands a recent survey (Wang, He and Wang, 2012) focusing on enterprise requirements for services in the cloud.

Business Factors in a Cloud IaaS Strategy
The business factors on an IaaS strategy are below:

Agility – Extent to which an edge in dealing with competitive markets and customer demand for improved products and services enabled IaaS;

Cost Benefits – Extent to which financial considerations enabled IaaS implementation;

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

Executive Involvement of Information Systems Organization – Extent to which participation of senior managers from internal technology organization(s) enabled IaaS implementation;
Globalization - Extent to which international dimensions enabled IaaS implementation;

Organizational Change Management – Extent to which internal organizational change management processes enabled IaaS implementation;

Participation of Business Organization – Extent to which participation of internal organizational staff enabled IaaS implementation;

Regulatory Requirements – Extent to which governmental or industry regulatory requirements enabled IaaS implementation; and

Strategic Planning and Cloud Computing – Extent to which implementation of IaaS was enabled or included in organizational strategic planning.

Procedural Factors in a Cloud IaaS Strategy
The procedural factors on an IaaS strategy are below:

Education and Training – Extent to which internal cloud education and training enabled IaaS;

Planning and Procurement – Extent to which organizational costing and planning of procurement techniques enabled IaaS implementation;

Process Management – Extent to which internal process improvement responsibilities, roles and techniques enabled IaaS implementation;

Program and Project Management – Extent to which program and project management teams enabled IaaS implementation;

Risk Management – Extent to which provider reviews, including cloud computing bill of rights for financial firm and service level agreements (SLA) with provider(s), integrated into internal risk management techniques enabled IaaS implementation;

Service-Oriented Architecture (SOA) – Extent to which SOA enabled IaaS implementation;

Standards – Extent to which open standards, participation in standards organizations or

processes of standards management enabled IaaS implementation of the technologies; and

Technology Change Management – Extent to which technology change management, including provider selection, enabled IaaS implementation.

Technical Factors in a Cloud IaaS Strategy
The technical factors of the model on an IaaS strategy are below:

Cloud Computing Center of Excellence – Extent to which cadre of internal organizational staff, knowledgeable in best-of-class practices of cloud computing technologies, enabled IaaS;

Cloud-to-Cloud Interoperability – Extent to which IaaS integration with other internal or external cloud systems or technologies enabled IaaS implementation;

Cloud-to-Non-Cloud Interoperability – Extent to which IaaS integration with other internal or external non-cloud systems enabled IaaS implementation;

Continuous Processing – Extent to which 24/7/365 resource availability enabled IaaS implementation;

Data – Extent to which information governance enabled IaaS implementation;

Elasticity of Processing Resources – Extent to which resources synchronization with processing requirements enabled IaaS implementation;

Infrastructure Architecture – Extent to which IaaS implementation integrated into internal organizational infrastructure;

Multiple Providers – Extent to which multiple providers enabled IaaS implementation;

Networking Implications – Extent to which internal organizational networking infrastructure enabled IaaS implementation;

Platform(s) of Provider(s) – Extent to which provider platform(s) enabled IaaS implementation;

Privacy and Security – Extent to which organizational and provider privacy and security techniques enabled IaaS implementation;

Problem Management – Extent to which problem management and monitoring tools enabled IaaS implementation; and

Tools and Utilities – Extent to which provider tools and utilities enabled IaaS implementation.

In this study, the authors improve the factors for IaaS projects from the factors for the SaaS systems in their earlier model (Howell-Barber et. al., 2012). The factors are largely the same as those in the previous study of SaaS systems, as the implementation of IaaS and SaaS (and even PaaS) systems is enabled in the cloud similarly by this methodology model. The conceptual framework for IaaS projects and systems, depicted in Figure 1 of the Appendix, is even founded generically on a larger model of the authors on service-oriented architecture - SOA (Lawler and Howell-Barber, 2008), as the services of SOA were the forepart to the services of the cloud.

4. FOCUS OF STUDY

The focus of this study is an evaluation of the aforementioned cloud framework on IaaS projects, as initiated or not initiated in a generic strategy for IaaS systems. The cloud and IaaS are highly important investments in the production systems of financial firms in 2013 (Yurcan, 2012). The foundation of the investment in a model of strategy is important to firms, as established providers as Amazon, Bluelock, CSC, IBM and Rackspace, and insurgent providers as Google, HP and Microsoft, expect further migration to IaaS and introduce numerous options for production workloads (Knorr, 2012) that necessitate review (Flood, 2013). The frequent hype from practitioner sources on cloud and IaaS necessitates reality reviews from a scholarly study (Sriram and Khajeh-Hosseini, 2010). Therefore, this study contributes a formidable framework for investment in a cloud computing IaaS strategy.

5. RESEARCH METHODOLOGY OF STUDY

The research methodology of this study comprised 5 financial firms from industry, chosen by the authors because of evident high innovation and payback in Infrastructure-as-a-Service (IaaS). The firms were cited frequently in credible consulting papers and leading practitioner publications in June – August 2012. The projects and systems of IaaS in the firms were evaluated by the first and second authors

in the August 2012 – April 2013 period, from a checklist instrument defining the 30 business, procedural and technical factors of the framework model of this study. The enablement of the factors on the key projects and systems, if not on strategy, were evaluated by the authors on a six-point Likert-like rating scale: 5 – very high, 4 – high, 3 – intermediate, 2 – low, 1 – very low, and 0, in evidence of the factors. The evaluations were founded on in-depth observations of senior management stakeholders in the firms; perceptions of observation rationale by the second author, an experienced industry practitioner; and reviews of secondary technology industry studies by the third and first authors, which were filtered first for hype by the second author.

The checklist instrument was evaluated in the context of construct, content and face validity, and content validity measured in the context of sampling validity, by the fourth and first authors. The methodology was in conformance with principles of Yin (Yin, 2013). The methodology of this study was consistent in creditability and reliability with that included in the previous studies of the authors (Lawler et. al., 2011 and Howell-Barber et. al., 2012).

The data from the evaluations were interpreted in MATLAB 7.10.0 Statistics Toolbox measurements (McClave and Sincich, 2006) by the fourth author, for presentation in the following section.

5. ANALYSIS OF FINANCIAL FIRMS OF STUDY

Detailed Analysis and Discussion of Firms*

Firm 1: National Banking Institution
Firm 1 is a large-sized national banking institution that emphasized a consolidated cost-efficient hybrid infrastructure from its different IaaS providers. The objective of the project was to customize the commercial contracts of the providers to the on-demand processing requirements of the firm; cut dependence on individual providers in order to facilitate flexible platforms for portability; and design and implement an environment for services controlled more by the firm. The project resulted in a greatly improved infrastructure integrated for the provisioning of systems.

The business factors of *agility* (5.00) and *cost benefits* (5.00) were the drivers of the project. The procedural factors from *education and training* (5.00) to *technology change management* (5.00), including the factor of *program and project management* (5.00) was evident fully on the project. The procedural factors of the framework model were highly important in provider standardization. The technical factors from *cloud computing center of excellence* (5.00) to *tools and utilities* (5.00) were evident highly on the project, similar to the technical factors. To ensure the future of the improved infrastructure, *strategic planning and cloud computing* (5.00) was evident highly on the project.

Firm 1 was focused methodically on a full IaaS resource strategy that furnished success.

Firm 2: Consultative Trading Institution
Firm 2 is a small-sized northeast trading institution that emphasized a faster public Euronext infrastructure from a provider. The objective of the project was to furnish high-frequency processing for mathematical models for specialist traders. The project resulted in an improved infrastructure for real-time trading.

The business factors of *agility* (5.00) and *cost savings* (5.00) were evident highly on the project, and *executive involvement of the information systems organization* (5.00) was evident in negotiating with the provider. The procedural factors were evident highly on the project, similar to those in Firm 1, including *risk management* (5.00) of the infrastructure for high-frequency volatility. The technical factors from *cloud computing center of excellence* (5.00) to *problem management* (5.00) were evident largely on the project, but in one provider were simplified than in Firm 1.

Firm 2 was focused on a simplified solution that on future projects will serve as an initial IaaS strategy.

Firm 3: Securities Trading Institution
Firm 3 is a large-sized securities trading institution that emphasized a public Amazon Web Services (AWS) infrastructure for information retention. The objective of the project was to furnish improved methods for record retention; increase services to other securities trading institutions at lower costs; and to integrate mandated regulatory requirements for increased transparency. The project resulted in an improved platform for scalability of storage.

The business factors from *agility* (5.00) to *executive involvement of the technology organization* (5.00) were evident highly on this project, especially the factor of *regulatory requirements* (5.00). Except largely for *risk management* (5.00), procedural factors were not as evident on this project as on the projects in Firms 2 and 1, as Firm 3 focused on a narrow niche of reporting requirements of the Commodity Futures Trading Commission and the Securities and Exchange Commission (SEC). The *participation of the* business *client organizations* (2.00) was not even as evident as in Firms 2 and 1. The technical factors, including *privacy and security* (5.00), were as evident highly on this project as on the projects in Firms 2 and 1. The business, procedural and technical factors strengthened *strategic planning and cloud computing* (4.00) in a limited but strong strategy.

Firm 3 was focused on the public provider retention service of infrastructure, not other services, as an IaaS strategy.

Firm 4: Commercial and Consumer Lending Organization

Firm 4 is a medium-sized north-central commercial and consumer lending organization that focused on hardware integration onto a private WMware platform. The purpose of this project was to lessen data center server sprawl of subsidiary systems; and to lessen data center staff. The result of this project was an infrastructure integrated for processing requirements throughout the organization with less purchasing and less staff.

The business factor of *cost benefits* (3.00) was evident on the project, but not as highly as on the projects in Firms 3, 2 and 1. The procedural factors of *planning and procurement* (5.00), *process management* (5.00), *program and project management* (5.00) and *technology change management* (5.00) were highly notable on the project, in order to ensure the infrastructure migration from public to private provider systems. The procedural factor of *education and training* (5.00) and the technical factor of *cloud computing center of excellence* (5.00) were notable similarly, for internal skills were needed for integration of the systems. The technical factors of *cloud-to-non-cloud interoperability* (5.00), *continuous processing* (5.00), *infrastructure architecture* (5.00) and *tools and utilities* (5.00) were notable too. The factors of the framework model were largely subordinate to *strategic planning and cloud computing* (5.00) in a semblance of strategy.

Firm 4 was focused on an IaaS resource and staffing plan that furnished success as in Firm 1 and was furnished a foundation for other resources and systems to migrate to IaaS with this strategy.

Firm 5: International Financial Services Organization

The final firm of the case study, Firm 5, is a large-sized international financial services organization that focused on integration of private Rackspace resources for internal development staff. The purpose of this project was to move localized resources to infrastructure of UNIX and Windows platforms, so that services were sharable at lower costs with more staff. The result of this project was a infrastructure integrated at lower costs for services throughout the organization.

The business factor of *cost benefits* (5.00) was evident highly on the project, as on the projects of the other firms. Inasmuch as the information systems project was on services of software technologies, *executive involvement of the technology organization* (4.00) was evident almost as highly as on the other projects, but *executive involvement of the* business *client organizations* (1.00) was not as evident on this project as on almost all of the other projects, nor was *participation of the client organizations* (2.00). Other than the procedural factor of *service-oriented architecture* (5.00) the procedural factors were not evident highly in an immediate intention for project results. The technical factors of *cloud-to-non-cloud interoperability* (4.00), *elasticity of processing resources* (5.00), *platform of provider* (5.00) and *tools and utilities* (5.00) were evident highly in the infrastructure integration on this project. Though productive, this project was not subordinate to *strategic planning and cloud computing* (2.00) and was without a strategy for other resources and services.
Firm 5 was focused on a project that furnished a service solution on IaaS but was without a strategy for furnishing future success of IaaS systems.

*Firms are classified as confidential because of competitive considerations in the industry.

Collective Analysis and Discussion of Firms

The case study on IaaS discloses procedural (3.75) factors more frequent than technical (3.65) and business (3.60) factors, detailed in Table 1.

In detail the case study discloses the business factors of *agility* (3.80) and *cost savings* (5.00) as drivers on the projects, enabled more by *executive involvement of the information systems organizations* (4.80) than by *executive involvement of the business organizations* (3.60). The factor of *regulatory requirements* (3.60) was enabling the financial industry projects. The procedural factors of *planning and procurement* (4.00), *process management* (3.80), *program and project management* (3.80), *risk management* (4.60) and *technology change management* (4.60) were evident in governance on most of the projects; and the technical factors of *cloud-to-non-cloud interoperability (4.80), infrastructure architecture* (4.80), *platforms of providers* (3.80), *privacy and security* (5.00) and *tools and utilities* (4.20) were evident on most of them, enabled by *education and training* (4.20) and *cloud computing center of excellence* (4.00), detailed in Table 2. Though almost all of the projects were investing limited services on IaaS and not critical few objective systems, most of them were involving a planning, program and project management and risk management methodology that furnished a foundation for incrementally migrating other services to IaaS in a strategy.
In short, the narrow project services in this study furnished the potential of a productive IaaS strategy.

(The correlations and the frequency of ratings from the case study are furnished in Tables 3 and 4 for review.)

6. IMPLICATIONS OF STUDY

The financial firms in the case study are benefiting from cost savings of Infrastructure-as-a-Service (IaaS). However, the firms are cautious about investing in critical few objective systems on IaaS, due to constraints of increasing industry regulation. They are focused on investment in limited systems not integrated with other systems that may be on IaaS or on other Platform-as-a-Service (PaaS) or Software-as-a-Service (SaaS) systems, more than in the previous SaaS study (Howell-Barber et. al., 2012). They gain a competitive edge in the industry in investment in provider services, but the investment is marginal if they are hesitant about integration of potential systems with IaaS technologies. The implication is that these firms benefit from IaaS but may benefit further from a cohesive plan for a strategy.

The firms in most of the study are also benefiting from fundamental governance of the IaaS projects. Planning, process management and project management are enabling the implementation of most of the projects, if not facilitating IaaS infrastructure standardization (Pande, 2012). Risk management is facilitating regulation sensitivity. These factors of the framework of the study are furnishing a foundation for an incremental integrative migration of other systems on to IaaS provider technologies. The implication is that these firms may eventually formulate a plan so that infrastructure systems are subordinate to an IaaS, if not a larger PaaS, SaaS and IaaS strategy.

Finally, the information technology organizations of the firms are clearly the drivers of the IaaS projects in the study. The enterprise architects of the organizations are enabling the IaaS projects at higher involvement than the client organizations of the firms, as IaaS systems are inherently technical. These firms are fortunate in having in-house technologists not only passionate but skilled to move them on to the cloud and IaaS provider technologies – a requirement (Linthicum, 2012b) for which shortages are cited frequently in the literature (Adams, 2012 and McDougall, 2012). The intricacies of the cloud IaaS projects in networks, servers and systems, as they related to non-cloud organizational systems, had to be managed not by the provider staff but by these technologists. The implication is that these firms have an opportunity to pursue other projects and systems on the cloud with their own technologists and to hopefully pursue a strategy.

7. LIMITATIONS AND OPPORTUNITIES IN RESEARCH

The study is limited to a few firms in the financial industry initiating innovation in the cloud. The study is further limited by the inherent immaturity and limited number of IaaS projects and systems in the industry, and the purposes of the projects and systems in the

firms of the study are specific to these firms, which may be a limitation. Moreover, the hesitation of senior management in fully informing on the intricacies of IaaS systems is a limitation of external studies. Nevertheless, this study furnishes good indications of factors facilitating initiatives of managers in the technology. This study furnishes a framework for investment in this method of cloud computing technology for the financial sector if not non-financial sectors that may be helpful to future researchers.

8. CONCLUSION OF STUDY

The cloud computing model of Infrastructure-as-a-Service (IaaS) is benefiting financial firms, despite the immaturity of the model. The findings on the firms in the study indicate that procedural factors are more frequent than technical and business factors on projects of IaaS. The focus on less impact and less larger systems found in the study indicates that IaaS is in its adolescence in the industry, as investment in provider services is for largely localized low rate-of-return systems. The hesitation is from generally issues of privacy, regulation and security on IaaS systems, cited often in the literature. The investment is largely limited to non-integrated small systems. However, the management process for implementation of the systems is indicated in the study to be rigorous and sensitive with qualified technologists. Nevertheless, neither non-technical nor technical senior management of the firms in the study is interested in planning a robust strategy with the technology. Still, this study furnishes a flexible methodology that will be helpful to senior management and practitioner staff, as more systems integrating onto IaaS would benefit from a strategy. The model of this study will be helpful as a utility to researchers studying IaaS in the financial sector and other sectors.

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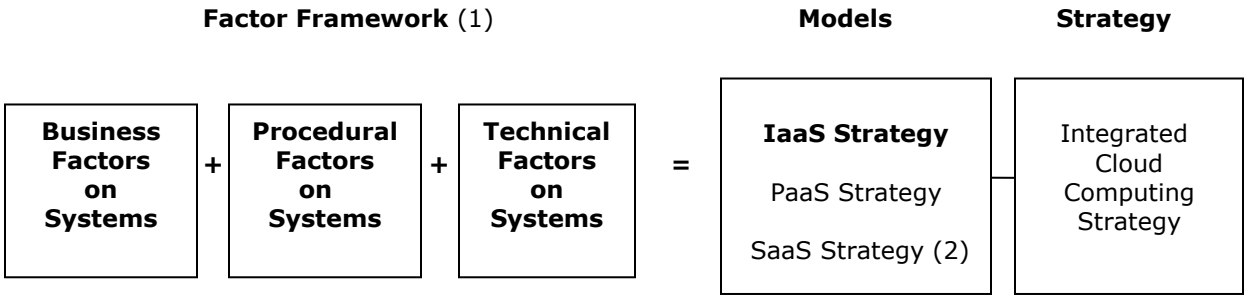
APPENDIX

Figure 1: Cloud Factor Framework for Cloud Computing Strategy – Conceptual Model of IaaS Study



Note: Factors are enhanced for individual IaaS, PaaS and SaaS models.

Sources: (1) Lawler et. al., 2011
(2) Howell-Barber et. al., 2012

Table 1: Collective Analysis of Categorical Factors of 5 Financial Firms of IaaS Study

Categorical Factors of Models	Means	Standard Deviation
Business Factors	3.60	1.59
Procedural Factors	3.75	1.61
Technical Factors	3.65	1.91

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

Table 2: Detailed Analysis of Factors of 5 Financial Firms of Iaas Study

Factors of Model	Firm 1 Means	Firm 2 Means	Firm 3 Means	Firm 4 Means	Firm 5 Means	Summary Means	Standard Deviations
Business Factors							
Agility	5.00	5.00	5.00	3.00	1.00	3.80	1.79
Cost Benefits	5.00	5.00	5.00	5.00	5.00	5.00	0.00
Executive Involvement of Business Organization	3.00	5.00	5.00	4.00	1.00	3.60	1.67
Executive Involvement of Information Systems Organization	5.00	5.00	5.00	5.00	4.00	4.80	0.45
Globalization	2.00	2.00	1.00	0.00	2.00	1.40	0.89
Organizational Change Management	4.00	2.00	2.00	4.00	2.00	2.80	1.10
Participation of Business Client Organization	3.00	5.00	2.00	4.00	2.00	3.20	1.30
Regulatory Requirements	4.00	5.00	5.00	4.00	0.00	3.60	2.07
Strategic Planning and Cloud Computing	5.00	5.00	4.00	5.00	2.00	4.20	1.30
Procedural Factors							
Education and Training	5.00	5.00	3.00	5.00	3.00	4.20	1.10
Planning and Procurement	5.00	4.00	4.00	5.00	2.00	4.00	1.22
Process Management	5.00	4.00	3.00	5.00	2.00	3.80	1.30
Program and Project Management	5.00	4.00	3.00	5.00	2.00	3.80	1.30
Risk Management	5.00	5.00	5.00	3.00	5.00	4.60	0.89

Service-Oriented Architecture (SOA)	5.00	0.00	4.00	0.00	5.00	2.80	2.59
Standards	5.00	4.00	1.00	0.00	1.00	2.20	2.17
Technology Change Management	5.00	5.00	5.00	5.00	3.00	4.60	0.89
Technical Factors Cloud Computing Center of Excellence	5.00	5.00	3.00	5.00	2.00	4.00	1.41
Cloud-to-Cloud Interoperability	4.00	0.00	0.00	0.00	0.00	0.80	1.79
Cloud-to-Non-Cloud Interoperability	5.00	5.00	5.00	5.00	4.00	4.80	0.45
Continuous Processing	2.00	5.00	5.00	5.00	1.00	3.60	1.95
Data	2.00	5.00	5.00	1.00	5.00	3.60	1.95
Elasticity of Processing Resources	5.00	3.00	5.00	4.00	5.00	4.40	0.89
Infrastructure Architecture	5.00	5.00	5.00	5.00	4.00	4.80	0.45
Multiple Providers	5.00	0.00	0.00	0.00	0.00	1.00	2.24
Networking Implications	3.00	5.00	5.00	1.00	4.00	3.60	1.67
Platform(s) of Provider(s)	5.00	5.00	5.00	0.00	4.00	3.80	2.17
Privacy and Security	5.00	5.00	5.00	5.00	5.00	5.00	0.00
Problem Management	5.00	5.00	4.00	5.00	0.00	3.80	2.17

Tools and Utilities	5.00	3.00	3.00	5.00	5.00	4.20	1.10

Legend: Refer to Legend in Table 1.

Table 3: Correlations between Pairs of Financial Firms of IaaS Study

	Firm 1	**Firm 2**	**Firm 3**	**Firm 4**
Firm 1				
Firm 2	0.5056			
Firm 3	0.1715	0.6840		
Firm 4	0.0850	0.4321	0.5646	
Firm 5	0.1620	0.0658	-0.0082	0.2893

Note: The correlations between Firm 2 and Firm 1, Firm 3 and Firm 2, Firm 4 and Firm 2 and Firm 4 and Firm 3 are significant statistically relative to zero at the 5% level of significance.

Table 4: Frequency of Ratings across Factors of IaaS Study

	Firm 1	**Firm 2**	**Firm 3**	**Firm 4**	**Firm 5**
Ratings					
0	13.33%	6.67%	10.00%	20.00%	---
1- Very Low	13.33%	6.67%	---	6.67%	---
2-Low	26.67%	6.67%	6.67%	---	10.00%
3-Intermediate	6.67%	6.67%	6.67%	6.67%	10.00%
4- High	16.67%	13.33%	13.67%	16.67%	10.00%
5- Very High	23.33%	50.00%	63.33%	50.00%	70.00%

A Feasibility Study of Platform-as-a-Service Using Cloud Computing for a Global Service Organization

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Abstract

This paper reports on an investigation of information technology (IT) enablement for a global service organization (small/medium enterprise [SME]), with focus on the feasibility of Platform-as-a-Service (PAAS) using cloud computing technology. A positivist-empirical research approach was followed to perform the feasibility analysis while also leveraging the benefits of cloud computing for an enterprise portal in a way that adds value for the enterprise. The following tasks were performed: (1) problem analysis of services, (2) literature review, (3) conceptualization of problem, (4) initiation and scope definition, (5) feasibility study, and (6) conceptualization of proposed solution. There were two main deliverables, namely the feasibility report and a proposed implementation. The feasibility report provides analyses that align the IT strategy and enterprise strategy; a tactical and strategic analysis; a business process analysis; a defined value proposition; a cost benefit analysis; and a process performance analysis. Based on the feasibility report an acquisition proposal for a cloud-based portal with a PAAS implementation is formulated. The paper provides cloud practitioners with some recommendations and practical references relating to implications for practices and procedures in the services agency domain, security requirements, training requirements, and phased process improvement. The findings of this investigation contribute to the body of knowledge for both academics and professionals regarding e-business. The investigation was conducted as part of an academic course in collaboration with a real-world small to medium size agency with limited resources. There are two limitations to this investigation: first, the proposed solution is conceptual and will be implemented in the next phase of the research project, and second, generalization of the proposed solution has potential and the solution could be examined for other service domains.

Keywords: cloud computing, Platform-as-a-Service, business process improvement, process performance matrix.

1. INTRODUCTION

Business process improvement leveraging information technology (IT) enablement has become an important approach and potential solution in many organizations (Davenport, 1993; Shtub & Karni, 2010). Also, the number of the organizations utilizing advanced IT approaches has been increasing in different industry fields due to the rapid development of the Internet-based technologies (Dutta & Mia, 2010; Oliner & Sichel, 2000). Cloud computing,

as a new computing model running on the Internet, provides many organizations with a number of new IT-based solutions and benefits, such as moderate cost, agility, and high efficiency (Gai & Li, 2012; Thomas, 2009). It is evident that leveraging cloud computing to improve business processes is a hot topic in many industries.

This paper reports on an investigation on IT enablement that would improve business processes and add value for a global service agency (GESA), a small/medium enterprise (SME), which provides study abroad services to global customers. The purpose of the project was to examine the feasibility of improving the business processes and adding value for the agency by implementing a cloud-based portal with Platform-as-a-Service (PAAS).

The main problems of the enterprise were identified, and two research questions formulated, as follows:

1. What is the feasibility of creating new web-based services for a global service enterprise that would add value through a cloud-based approach?
2. What business processes of a global service enterprise are impacted when adopting cloud computing?

The main outcome of the investigation is a business and technical feasibility report, consisting of a variety of analyses and plans, such as a business process analysis, project activation analysis, acquisition process management plan, identified principles, driven-forces analysis, critical successful factors, project management plan, risk management plan, business process performance analysis, and strategic plan. This paper is structured as follows: problem analysis, research methodology, findings, limitations, and conclusions.

2. PROBLEM ANALYSIS

In recent years IT has become an important option for enterprises to add value to their products or services (Maizlish & Handler, 2010; Alavi, Yoo & Vogel, 1997). In many situations IT systems can help enterprises to reduce costs, increase efficiency, or improve/create services. With the advent of globalization the advantages of IT have become significant by connecting customers and corporations more efficiently. The capabilities of IT systems also bring some opportunities for companies to add value, improve their business processes, and enable a lean transformation by means of a range of IT-based solutions (Ilebrand, Mesoy & Vlemmix, 2010). In this context problem analysis is a fundamental process of understanding the nature of value creation by means of IT approaches.

GESA facilitates study abroad offerings for mainly Chinese students. The vision of the agency is to promote global awareness and exchange of knowledge through cross-cultural education. The mission is to provide individuals or organizations with educational opportunities between China and the United States that enhance international understanding between the two countries, and a lifelong learning mindset.

In order to achieve these strategic aims the agency has been operating a website that provides basic information about the organization and its services. Nevertheless, the limited scope of the website cannot effectively support the business processes, and it became clear that two main problems should be resolved as a priority. The first is that the functionality of the website is not sufficient to add value to the services and build a bridge between customers and the agency. Most business activities cannot be completed on the website and customers do not have access to acquire a service or send a service request via the interface provided by the website. This lack of access to services results in a low-level interaction between the agency and its customers, and is also not positive for service improvement.

Secondly, the agency operates its business in a global context so that a fully functional website is really important for the company to expand its market and communicate with its potential customers, as has also been found by others (Liu, Arnett, Capella & Beatty, 1997; Turban, Leidner, McLean & Wetherbe, 2008). The current status of the website may not be able to enhance the fine reputation of the company in the target market and build a good customer relationship (Liang & Chen, 2009). Improvement of business processes via a new IT enablement is a necessity for this organization.

The objectives of service improvement were distilled to the following: (1) improving business processes through a cloud-based portal, (2)

adding value to the existing services and creating new services, (3) reducing costs, and (4) increasing efficiency by leveraging state-of-art IT functionalities.

In order to attain these objectives, the proposed service improvement focused on a competitive strategy, key value chains, representative business processes in the services industry, approaches to process improvement, and cloud computing. The analysis of business process improvement is considered from three perspectives, namely strategic perspective, business process perspective, and technological perspective.

Strategic Perspective

The strategic perspective mainly addresses issues that contribute to business process improvement related to strategy. The analysis of the strategic perspective considered the value chains, aspects of a competitive strategy and the development of a strategy map.

A value chain refers to a chain of processes and activities that fully represent all behaviors or actions in an entire business process, which usually includes designing, producing, marketing, delivering, and other supporting activities (Porter, 1980). Each activity is aligned with a transition process, from resource extraction to service delivery, which implies a step of adding value (Cohen, 2010). The primary and support activities in the generic value chain model of Porter (1980) were interpreted for GESA: the primary activities (including services, finance, marketing, and sales); and support activities (i.e. the organization infrastructure, electronic customer relationship management [eCRM], services management and training, and procurement). Figure 1 shows the value chain of the agency. Cognizant of the agency's external environment on a strategic level, and understanding the value chains and main processes and activities, a competitive strategy may be formulated to guide the planning of service improvement (Harmon, 2007).

The competitive strategy theory supports enterprises to obtain competitive advantage by means of a set of methodologies and principles.

When effective a competitive strategy can position value creation initiatives in a particular market situation (Porter, 1980; Porter, 1985, Steenkamp, Li & du Plessis, 2004). Three positioning strategies, namely cost leadership (low cost), differentiation (through high quality), and niche specialization (through targeting special customers) were considered (Gartner, 1985; Porter, 1985).

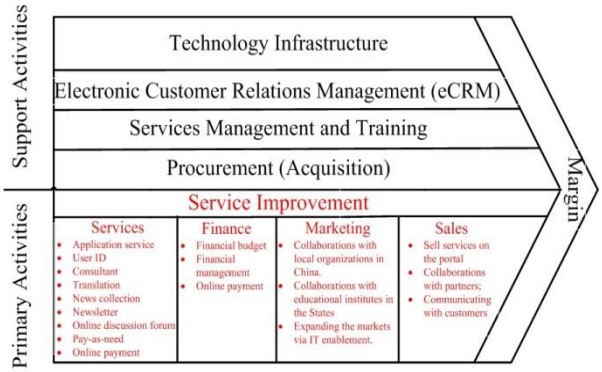

Figure 1. Value Chain of the Agency

Figure 2 presents a value map of positioning various services in the global education agency industry. By understanding the positions of value creation in the market place, GESA should become aware of the main changes and threats in the competitive global environment.

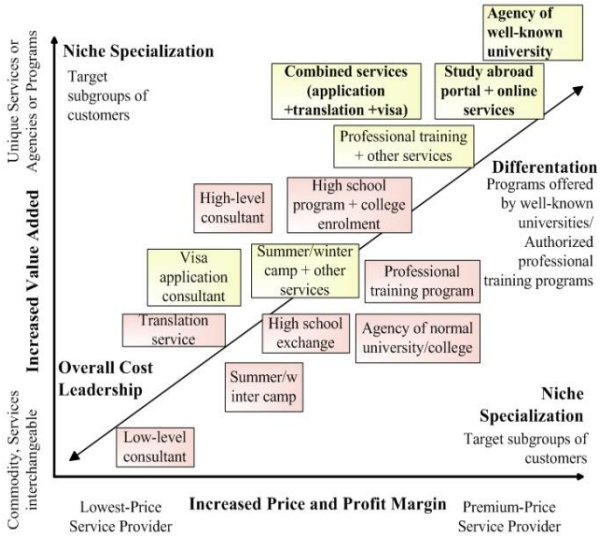

Figure 2. Value Map of Positioning Services

Porter (1980) proposed the Five Forces Model (FFM), which identifies five main changes in the competitive environment, and provides a (competitive) methodology that can enable a company to compete within an existing industry sector. The five forces include industry competitors (other agencies), buyers (potential students), suppliers (educational institutions), substitutes (alternative service organizations), and potential entrants (new agencies) to an

industry (the services industry). Figure 3 presents the FFM instantiated for GESA.

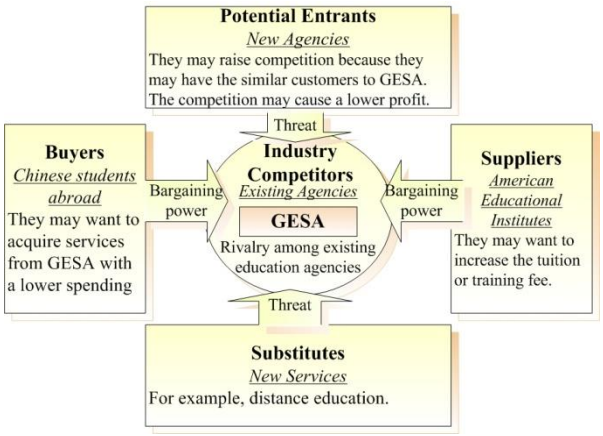

Figure 3. Five Forces Model instantiated for GESA

Based on the competitive strategy analysis a strategy map leveraging an IT-based solution was developed using the Balanced Scorecard Approach model (BSA). This model was developed by Kaplan and Norton (2004), who have both greatly contributed to the body of knowledge in the Harvard approach to strategy (Harmon, 2007; Jensen, 2002). Kaplan and Norton (2004) emphasize that the performance measures for a strategy should include not only the financial perspective but also three other perspectives, namely customer perspective, internal perspective, and learning and growth perspective. A balanced consideration from these four perspectives can provide an entire image of the strategy's performance measures, and may help enterprises to solve threats from different forces. Among the four perspectives, the internal perspective is core and describes the value-creating processes (Harmon, 2007). The analysis of internal processes and measures are vital to eventually create a process strategy in a specific manner. Appendix 2 presents a strategy map that theoretically follows the BSA model, and shows the ways of involving IT from various strategic perspectives.

Business Process Perspective

From a business process perspective, the enterprise needs to understand the operations of the supply chain and business processes that are aligned with the results of strategic analysis. The Supply Chain Operation Reference (SCOR) model was adopted to interpret the supply chain architecture for GESA.

As one of the first cross-industry frameworks for supply chain operations, the SCOR model enables one to evaluate and improve the performance and management of an enterprise's supply-chain in diversified business environments, and has been adopted by many global companies (Gordon, 1997; Siegl, 2008). A SCOR thread diagram is given in Figure 4 to illustrate the GESA supply chain process.

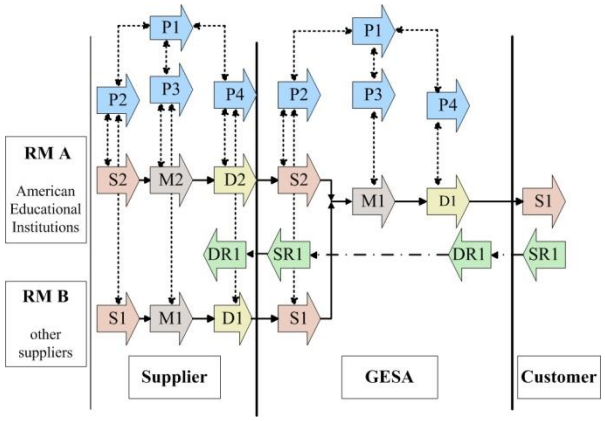

Figure 4. A SCOR Thread Diagram Illustrating the GESA Supply Chain Process

In this diagram there are two supplier reference models (RM), namely RM A (American educational institutions) and RM B (other participating organizations or individuals). In RM A, GESA collaborates with American educational institutions that literally offer customers training or instructional services. The existing program offerings may be revised or redesigned in terms of the needs of GESA's clients, which is considered as a Make process. In order to implement the Make process, the educational institutions should utilize their instructional source to formulate a number of educational service offerings, which can effectively support the collaboration between GESA and the educational institutions. The process of optimizing and collecting an educational source is defined as a Source process.

Meanwhile, GESA needs to re-organize the information of the programs offered by the American educational institutions in order to make them appropriate for their Chinese clients. For example, the introduction materials of the programs must be understandable for Chinese readers and the structures should follow Chinese reading customs and logical thinking. After the process of information re-organization, the services are presented to GESA's customers, which is a Deliver process.

Similarly, other organizations or individuals that could play a supplier role, here defined as RM B, may go through an analogous process in order to meet the requirements of collaboration. The thread diagram in Figure 4 explains the supply chain processes among suppliers, GESA, and customers. The letters in the arrows indicate that a process is a Source (S) process, a Make (M) process, a Deliver (D) process, a Plan (P) process, or a Return (R) process. The numbers after the letters represent the variation.

With the information from the suppliers, the enterprise is able to launch their supply chain process through the same procedure. Each process is corresponding to a Plan process. If customers cancel or change their intentions of service, a Return process will take place and the Source will be returned back to the supplier. Based on the implementation of the SCOR model, business process analysis was completed by adopting the Performance Matrix proposed by Rummler and Brache (1990) in order to understand the vital concerns in each business process of GESA.

The matrix, also known as the Performance Framework, is widely accepted in business and also the software development industry because it can effectively describe nine main concerns that enterprises, attempting to change their processes, must consider. It may also be adopted as a framework for IT enablement that addresses issues in different perspectives (concerns) on three levels. The perspectives are Goals and Measures, Design and Implementation, and Organizational Management shown as columns in the matrix. The three levels refer to the organizational, process, and activity (or performance) levels that explicitly represent the hierarchy of various processes and activities during process improvement. Appendix 1 shows the performance matrix for GESA.

The analysis of the strategic perspective and business process perspective informs the methodology of implementing IT-based approaches for a global service organization. The technology perspective includes cloud computing performance in the global service industry.

Technology Perspective

Cloud computing is a recent computing model that supports information sharing and services on the Internet or an Intranet, and clients can determine the service contents without dealing with cloud providers (Linthicum, 2009; Gai & Li, 2012). Linthicum (2009) identified at least six common benefits of using cloud computing, namely cost effectiveness, ease of access, driver forces of innovation, expandability, simple operations, and environmental protection. For GESA, a cloud-based solution is anticipated to result in reducing costs, increasing working efficiency, creating new services and adding value to the existing services, and improving business process management.

Lower maintenance costs and simplified business processes can help GESA to reduce costs and enhance operational efficiency. Software maintenance would be the responsibility of the cloud provider, and GESA would be able to focus on information input, content management, and marketing. Moreover, cloud computing provides an on-demand network, that introduces the possibility of creating new services via a cloud-based portal (Armbrust et al., 2010; Lin, Fu, Zhu & Dasmalchi, 2009). A number of new services, or some services that were formerly only offered offline, may be delivered via PAAS using cloud computing.

PAAS allows the customer to use virtual platforms rather than host a physical machine by accessing the virtual machine supported by a database running on the cloud (Stenzel, 2011). This service model of cloud computing can help enterprises to establish and test systems and new applications in a short period. New services are delivered by the applications running on the platform provided by the cloud. In this context the enterprise is considered as a cloud client, who is acquiring services from cloud providers, and this represents a convergence of cloud computing and service-oriented architecture (SOA).

The convergence of cloud computing and SOA is a promising and effective approach for an enterprise to provide a variety of online services. SOA provides a strategic meta-framework with a full set of principles and methodologies to design and develop software that provides customers with web-based services. From the perspective of the supply chain process, SOA adoption would improve the customer-side effectiveness of the electronic supply chain (Kumar, Dakshinamoorthy & Krishnan, 2007). The improvement would lead to a stronger connection between GESA and applicants, and achieve higher electronic supply chain performance. Appendix 3 illustrates a conceptual map of leveraging cloud computing in the global

context. With the delivery of services on the cloud and communicating with potential applicants GESA would become more efficient because its clients can access the GESA portal directly via the Internet and acquire services as needed.

3. RESEARCH METHODOLOGY

This section focuses on the research methods that were used and the rationale for adoption. A summary of the research design is given complementary to the information in Section 2.
A positivist-empirical research approach was followed to establish the feasibility of implementing PAAS, and leveraging cloud computing for GESA. In analyzing the research questions the investigation considered an IT enabling initiative for the agency which supports study abroad offerings for Chinese applicants, as explained in Section 2. The phases and steps of the research process model given in Appendix 4 are elaborated below.

Phase I – Initiation
The investigation began with an IT initiative proposal for a cloud-based portal for GESA, which provides an analysis of the competitive strategy and business processes leveraging a cloud-based portal. A feasibility analysis was done including establishing the value chains, business process analysis, and strategy mapping and resulted in a Feasibility Report. The BSA model was used to develop a balanced strategy in order to ensure the agency's survival in a competitive environment. The SCOR model was selected to identify the business processes that may be supported by PAAS because the model provides an effective approach to analyze supply chains in various industries.

Phase II – System Acquisition
An acquisition proposal for a cloud-based portal that provides a PAAS solution was developed. The acquisition proposal focuses on the main activities of the acquisition process, the modeling processes and activities. The acquisition process was elaborated to explain the process of obtaining an IT system that satisfies the needs of customers, and consists of a number of sub-processes, namely acquisition preparation, supplier selection, supplier monitoring, and customer acceptance.

Phase III – Findings
The main findings of the investigation relating to the feasibility study and development of the implementation proposal are reported in Section 4.

4. FINDINGS

This section highlights the key aspects of the feasibility report, as well as the proposed implementation.

Feasibility Report
The feasibility analysis results in a feasibility report, and includes the service improvement value chain, an effective supply chain, an IT enabled strategy map, and optimization of the acquisition process. Other benefits of leveraging cloud computing are provided, including the cost/ benefit, agility, and high efficiency.

As shown in Appendix 2, utilizing IT-based solutions is beneficial for the enterprise from four perspectives. Business processes may be improved via IT enablement in an internal perspective. The Operation Management Process is supported by a cloud-based supply chain, and the new services provided by a portal for GESA would strengthen customer management processes and innovation processes. The agility of the system is positive for dealing with the regulatory and social processes as well. Furthermore, considering the GESA customer value proposition, a healthy customer relationship would provide several benefits to applicants, such as lower price, more service selections, multiple accesses to information, and ease of operation. Moreover, with the improvement of business processes and customer relationship, the agency would be able to maintain a positive financial status. IT enablement can improve the cost structure, increase asset utilization, expand revenue opportunities, and enhance customer value in the financial perspective. Improvements from different perspectives suggest that the agency would be able to gain long-term shareholder value.

In order to optimize the acquisition process, evaluation criteria of supplier selection aligning with the agency's vision and objectives, were developed. The criteria are given in Table 1: cost, quality, safety, service, convenience, and agility. The criteria were based on the needs and goals of acquisition, and aligned with new services using the cloud-based portal. The new services include online application, online user identification, online consultant, online database service, translation service, news collection,

newsletter system, online discussion forum, service cost calculator, and online payment access. The alignment of business needs, technological support, strategic guidelines, and business processes is a necessary condition for operating the cloud-based portal for GESA.

Table 1. Evaluation criteria of supplier selection.

Criterion	Description
Cost	The cost of the service should be accountable for the enterprise. The system establishment fee and maintenance cost must be affordable.
Quality	The quality of the supplier must meet all the requirements listed in Appendix 5.
Safety	The supplier must guarantee the safety of information for both the company and customers.
Service	An in-time service is required; the supplier needs to give a timely response to the company's request.
Convenience	The system should be updatable, maintainable, and sustainable without extra financial burden.
Agility	The new services are portable; the information may be transferred to other cloud providers in the future.

Proposed Implementation

This section offers recommendations and practical references to cloud practitioners that cover the following aspects: implications for practices and procedures in the services agency domain, security requirements, training requirements, and phased process improvement.

For the purpose of improving phased processes, enterprises should identify the business processes, sub-processes, and activities. Appendix 6 illustrates drilling down into the online application process to examine three specific levels of processes, and is an example of the method of modeling processes and activities instantiated for various value chains (Harmon, 2007). As shown in the diagram GESA provides a number of value chains, with the customer orders as the inputs and school enrolments as the outputs. One of the value chains are formed by the new service that helps students to apply for admission to American educational institutions directly on the portal. The core process, "Applying for Schools", takes place in the production functional unit and the process consists of a few sub-processes, namely customer condition analysis, selecting schools, application material preparation, sending application package, contacting schools, and finish application. Drilling down into each sub-process identifies the activities and their main steps.

Appendix 7 is a process diagram which elaborates the process of the online application service. Customers need to complete the service order process, which consists of five processes, namely place order, receive order, review service request, revise order, and re-review order. Once the agency receives service requests from customers, a payment process and "Applying for School" process will take place synchronously. If the service is successfully delivered, the enrolment letter will be sent to the customer after the full service fee is paid. If the service is unsuccessfully delivered, the agency will refund the customer a certain amount of money (specified in the services agreement).

5. DISCUSSION

Leveraging cloud computing technologies to obtain value has become a popular approach for current enterprises. However, many enterprises have difficulties in determining whether they should use cloud-based services and how to leverage cloud-based services to add value to their products or services. The key contribution of this investigation is that it provides small/medium size enterprises with a concrete example of a feasible approach to creating an effective strategy to use a cloud-based platform. Compared to the traditional software development process, most development work and risks migrate to the cloud provider. The main task of cloud clients is to identify where the value may be added in the overall business process by leveraging cloud computing technologies, and devising an appropriate strategy.

The positivist/ empirical approach followed in this investigation resulted in grounding the proposed conceptual solution in existing management theories and techniques that support decision-making regarding cloud-computing adoption.

The investigation focused on one agency (GESA) offering global services for the study abroad domain, and the proposed solution is conceptual. A future project is planned to demonstrate the conceptual solution by implementing it in practice. In addition this solution has the potential for generalization in other services domains, and is in planning at the time of writing.

6. CONCLUSIONS

The key findings of the investigation are twofold, namely that it is indeed feasible to implement a cloud-based portal for a global service organization, and there are real prospects of value creation and service improvement. The small/medium sized global service enterprise, GESA, is expected to obtain some competitive benefits from leveraging PAAS with cloud computing. The benefits include reducing costs, business processes improvement, optimization of customer relationship, and new services creation. It was found that the SCOR model can aid an enterprise to understand its supply chain in a cloud-based environment. Moreover, modeling processes and activities should be conducted on three levels, namely processes, sub-processes, and activities with specific goals and measures in mind. The outcome of modeling processes and activities allows the enterprise to gain insight into the details of the business processes and behaviors on different levels.

A few questions for further consideration are (1) what is a feasible solution for security when a cloud-based platform is operated by a SME global service organization? (2) What would be the actual performance of the proposed implementation? And (3) Can the proposed solution be generalized in other service domains?

7. ACKNOWLEDGEMENT

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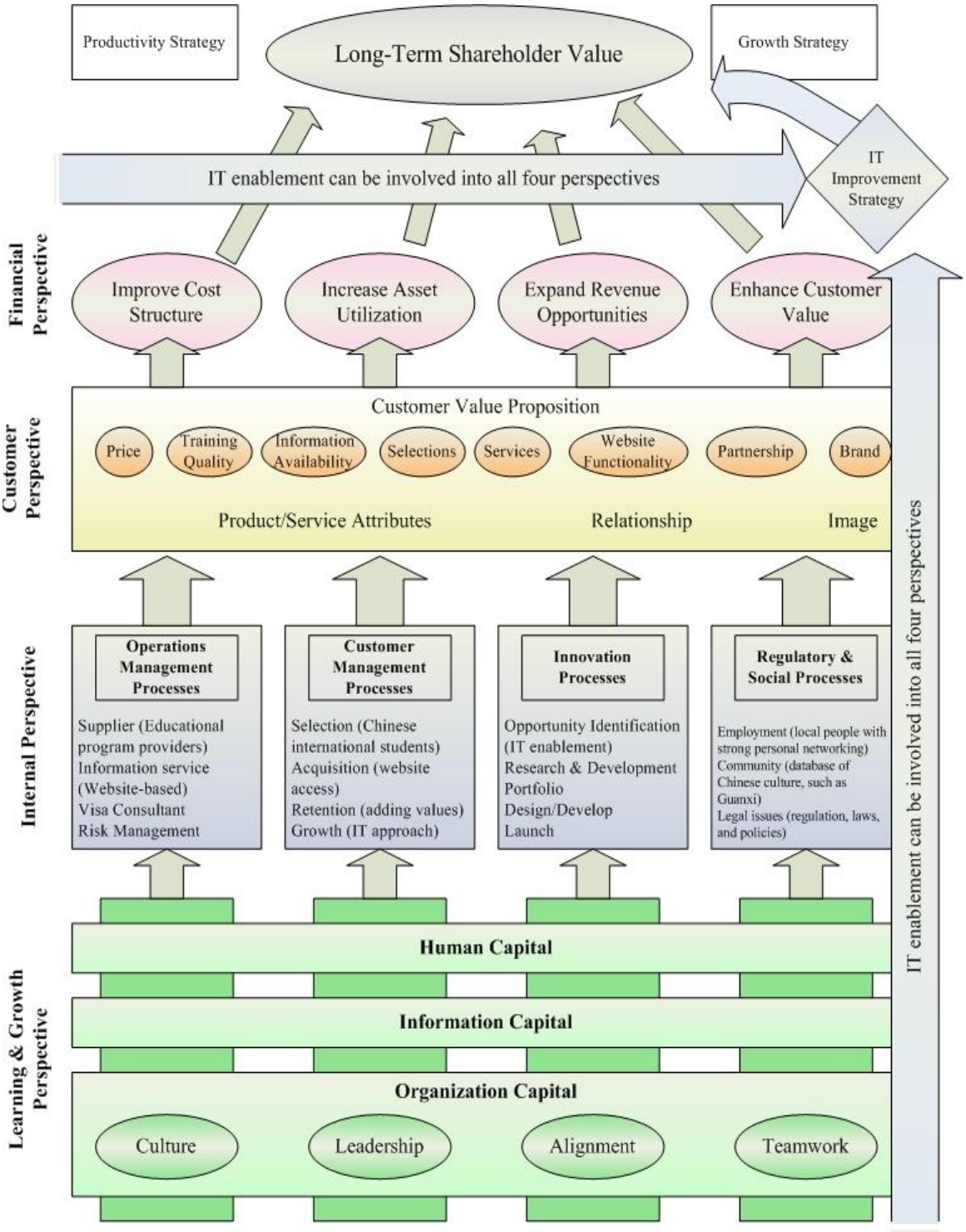
Appendices

Appendix 1 GESA Performance Framework

The columns show three perspectives and the rows display three levels. The corresponding information is respectively represented in the elements of the matrix.

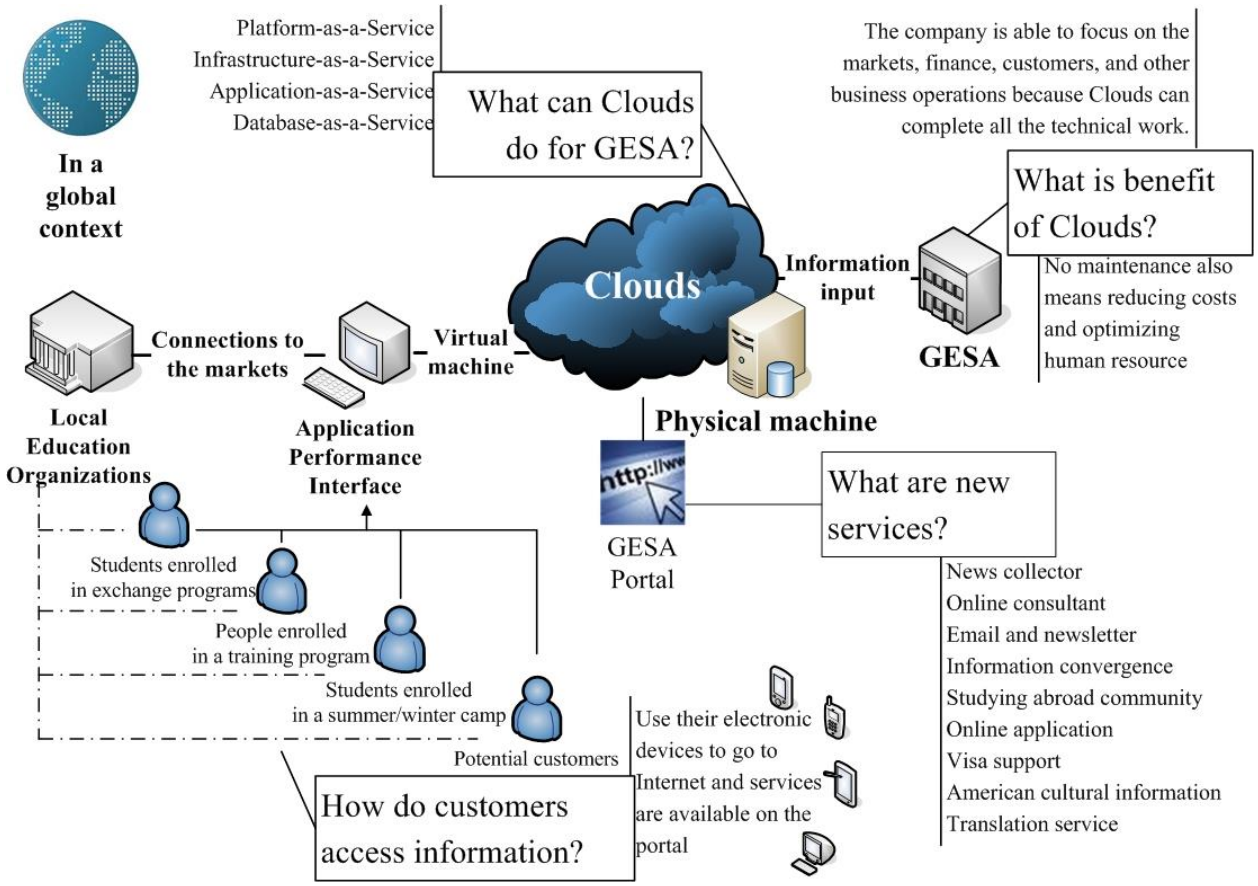
	Goals and Measures	**Design and Implementation**	**Organizational management**
Organizational Level	Goal: Provide clients with quality services relating the studying abroad. Measure: align with enterprise's vision, objectives, and missions.	- Develop the Strategic Plan for the purpose of delivering new services. - The plan should be feasible for the existing and new systems.	- Design, plan, execute, monitor, control, and evaluate the implementation of the portal. - Effective management ensures the quality of the initiative's operations.
Process Level	Goal: create ten new services through leveraging IT solutions, such as online application service, news collection, etc. Measure: use the criteria of supplier selection.	- Develop the IT Strategic Plan, identify the business processes and make sure the processes are operational. - Determine how the company can add value for service improvement. - Analyze the processes from different perspectives, such as financial, customer, internal, and learning and growth perspectives.	- Design, plan, execute, monitor, control, and evaluate the strategy of IT enablement. - Align the IT Strategic Plan with the Strategic Plan.
Activity level	Goal: risk management, acquisition management, project management. Measure: whether the outcomes match the service order and whether the performances follow the principles and concerns.	- Develop the IT Project Plan (Utilize a feasible technical method to achieve the goals and objectives, such as using Cloud computing in SOA. - The portal may be implemented in the Cloud).	- Design, plan, execute, monitor, control, and evaluate the implementation of IT enablement initiative in terms of the IT Project Plan. - Design a training process for employees. - Ensure and measure the new systems create new services with adding values. - Align the IT Project outcomes with the IT enablement strategic plan.

Appendix 2. Strategy Map formulated by means of the Balanced Scorecard Approach Model (on the basis of Harmon, 2007). Adapted from "Business Process Change: A Guide for Business Managers and BPM and Six Sigma Professionals (2nd ed.)" by Harmon, P. p.51.

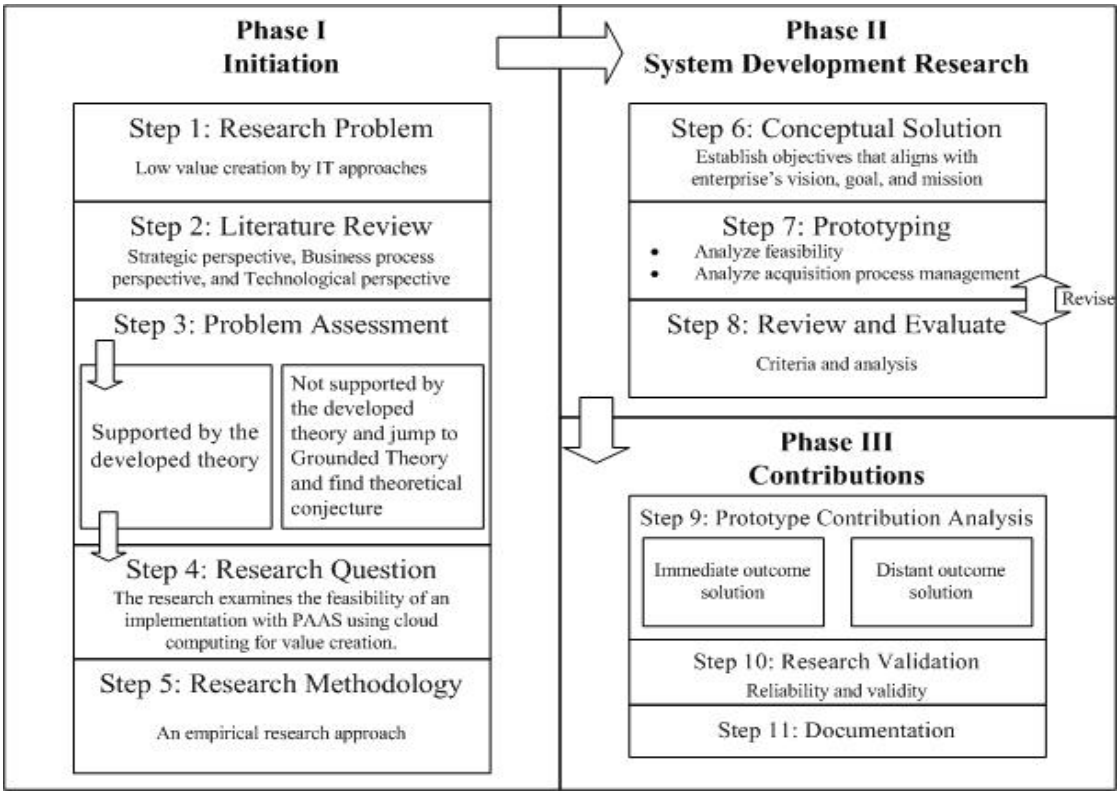


Appendix 3. A Conceptual Map of Leveraging Cloud Computing in a Global Context.

This diagram illustrates a conceptual map of leveraging cloud computing in the global context. With the delivery of services on the cloud and communicating with potential applicants GESA would become more efficient because its clients can access the GESA portal directly via the Internet and acquire services as needed.



Appendix 4. Positivist-Empirical Process Model

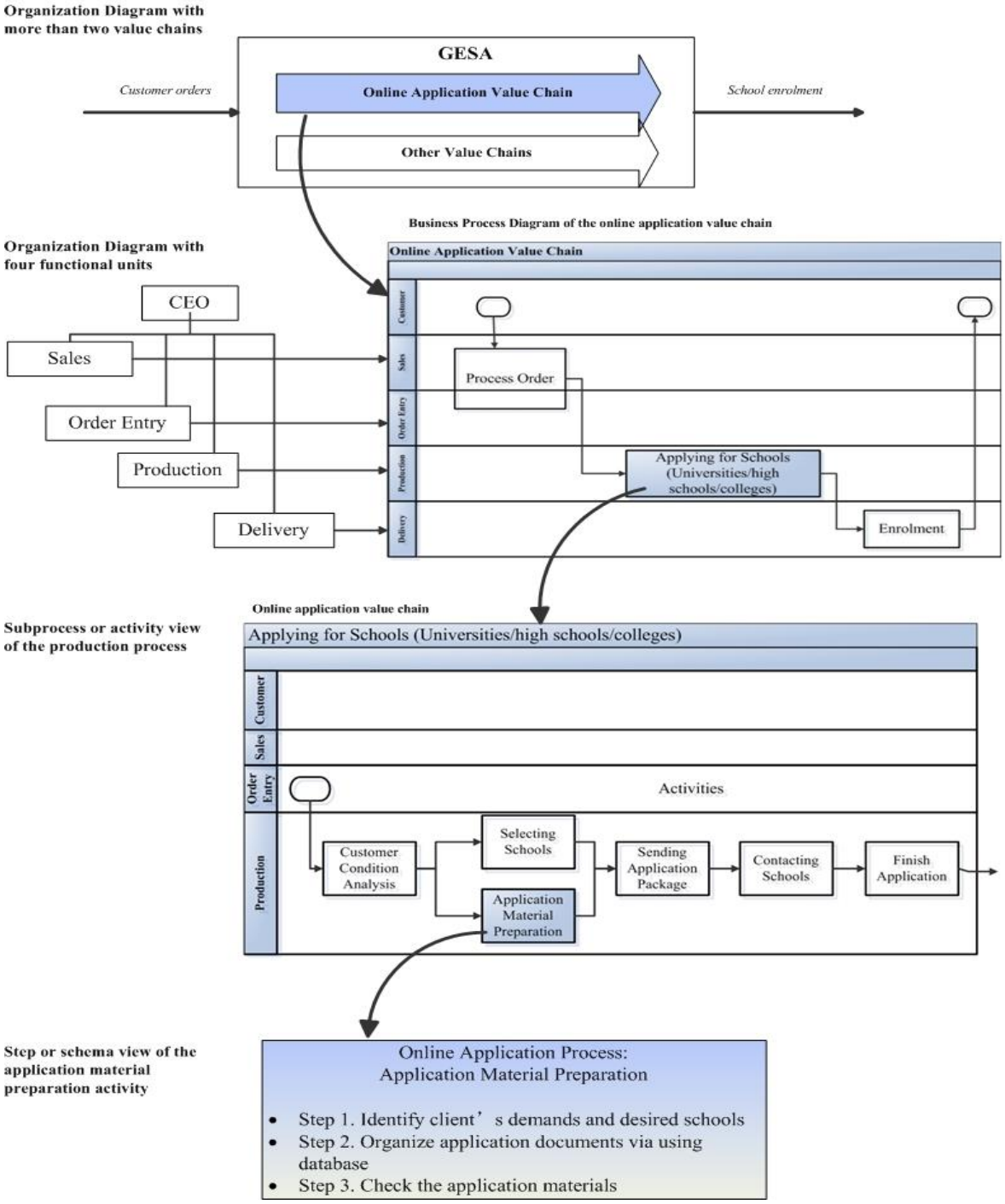


Appendix 5. Needs and Goals of the Acquisition.

Functions/Services	Description
Online Application	The portal provides students with an online application forum so that the GESA is able to obtain applicant's information and submit the application forms to various universities.
User Identification	The portal provides each client with an identification account (ID) that access to the services.
Online Consultant	The portal provides clients with an access to GESA's consultants. The consultants need to be specialized in the entire industry.
Online Database	The portal needs provide clients with abundant information related to the international education industry, such as general information of visa application and American general culture. The clients with authorized ID are allowed to obtain the information.
Translation Service	The portal needs two versions, one is in English and the other version is in Chinese. A translation service is available and the document submission system is required by the portal.
News Collection	The portal should provide the relevant updated news about the international education, such as new policies, statistics, and trends.
Newsletter	The portal needs have a newsletter function so that either authorized ID holders or website holders are able to receive updated information from the company.
Online Discussion Forum	An online discussion forum is required for sharing, discussing, or consulting.
Pay-as-need	The portal provides a service payment calculator, which can count the service costs on the basis of service items.
Online Payment	An online payment access should be available.

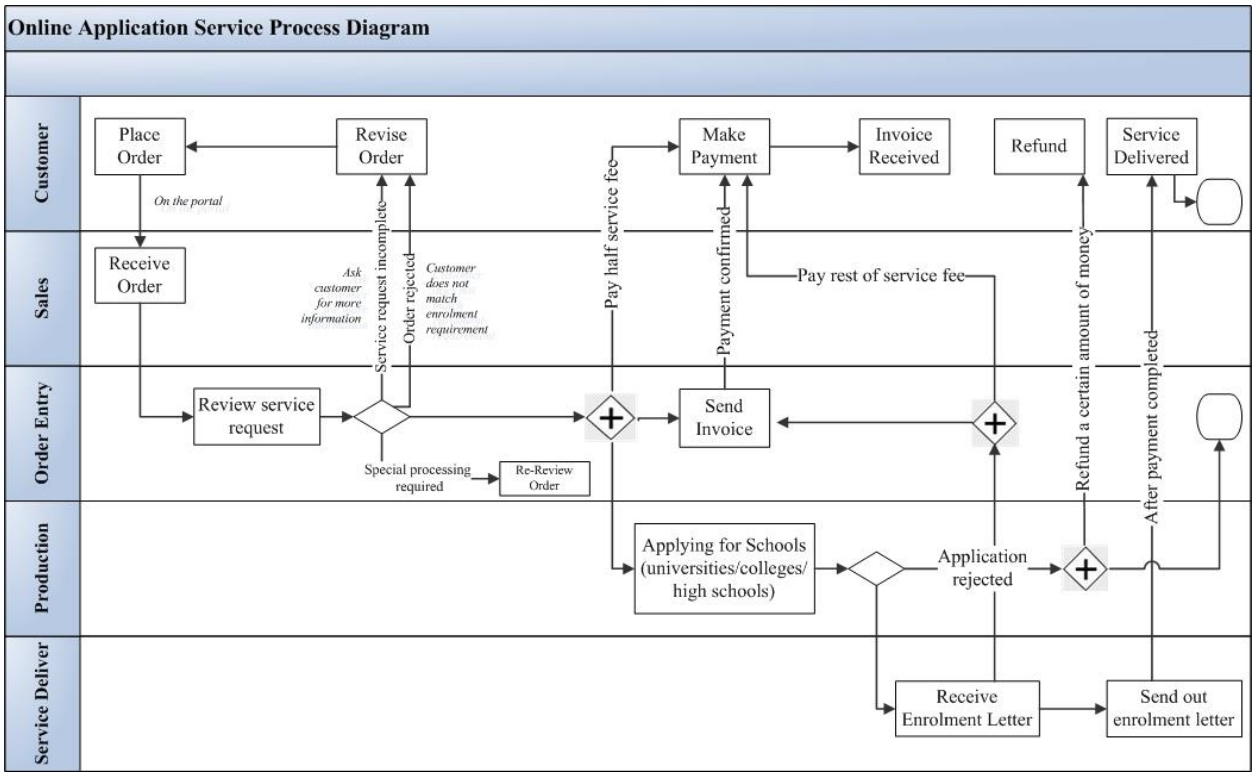
Appendix 6. Drilling Down into an Online Application Process to Examine More Specific Levels of Processes. Adapted from "Business Process Change: A Guide for Business Managers and BPM and Six Sigma Professionals (2nd ed.)" by Harmon, P. p.238.

This diagram illustrates drilling down a super process to examine three specific levels of processes, and is an example of the method of modeling processes and activities instantiated for various value chains (Harmon, 2007). (Refer below Appendix 7 for the notations used.)



Appendix 7. A Process Diagram Elaborating the Process of the Online Application service.

This process diagram elaborates the process of the online application service. Customers need to accomplish five steps in order to complete the service order. Once the order process is completed, an "Applying for School" process will occur synchronously and the agency will start delivering services. (Refer below for main notations used.)



The main notations used in Appendix 6 and Appendix 7 are as follows:

Main Notations	
Notation	Explanation
◇	Refers to gate way or decision making process
◈	Refers to parallel all inputs go to all outputs, but only when all inputs are ready to go together.
◈	Refers to exclusive, multiple input but the actual inputs come via only one path multiple output paths but only one is actually taken.

Performance and Corporate Social Responsibility in the Information Technology Industry

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Abstract

There are trade-offs between short-term and long-term effects of spending decisions. This is certainly the case when considering the implementation of Corporate Social Responsibility measures. The purpose of our research is to explore the relationships among corporate social responsibility (CSR) and financial success measures in the Information Technology and Telecommunications industry. More specifically, we examine the relationships between employee relations, an aspect of social responsibility, and accounting measures of efficiency and profitability. In addition, we investigate the relationship of these CSR aspects with Tobin's Q, a measure of market success. Our findings suggest that positive relationships exist between employee relations and accounting and market measures of success. However, we find no evidence that a negative relationship exists between poor employee relations and our success measures.

Keywords: corporate social responsibility, employee relations, accounting measures, Tobin's Q

1. INTRODUCTION

Corporate Social Responsibility (CSR) in general relates to the "economic, legal, ethical, and discretionary expectations that society has of organizations at a given point in time" (Carroll, 1979, p.500). While there is not a single definition of CSR, Wan-Jan (Wan-Jan, 2006) suggests the definition provided by Hopkins (2003), "that CSR means treating the stakeholders of the firm ethically or in a responsible manner." This conforms to the

argument that CSR should be an ethical stance without any expectation of getting rewards; however, it does not reject the notion that CSR could be aimed at enhancing profitability. Even Hopkins' definition of CSR does not necessarily provide clear direction when management is faced with a conflicting decision between the interests of stockholders and other company stakeholders. The neo-classical economists' view suggests that management decisions should be predicated on the objective of maximizing a company's long-term market value and thus the wealth of its owners. In contrast, stakeholder theory extends concerns to a wide spectrum of stakeholders including employees, customers, suppliers and the general community (Bird et al., 2007).

Besides the dilemma of stakeholder interests, CSR casts a wide net over controversial products or activities such as tobacco or gambling, the natural environment and human rights practices. A plethora of studies surrounding CSR focuses on these concerns. Our study, however, is focused on the employee as a corporate stakeholder. We look inward to the human resource practices and policies applied by an organization, and in particular, target the information technology and telecommunications (IT&T) industry.

The IT&T arena was chosen for investigation due to some of the uncommon employee practices and trends in this field. Three of the factors which lead to a varied employee setting are described. First, despite the current economic situation in the United States, there remains a need for qualified professionals in the IT&T fields. The United States Bureau of Labor Statistics March 29, 2012 Edition of the Occupational Outlook Handbook (Bureau of Labor Statistics, 2012) states,

> "Employment in professional, scientific, and technical services is projected to grow by 29%, adding about 2.1 million new jobs by 2020. Employment in computer systems design and related services is expected to increase by 47%, driven by growing demand for sophisticated computer network and mobile technologies."

A second reason for our focus on the IT&T industry is based upon the people already employed in this arena. The types of individuals that enter into this profession tend to have different expectations and work habits than the population at large. They are often focused on technology certifications and knowledge specialization. They are more likely to prefer project management oriented structures over more traditional management structures (Glen, 2003). In his book, Leading Geeks, Paul Glen makes several distinctions between the knowledge workers who specialize in the creation, maintenance, and support of high technology and others in an organization. For instance, they are loyal to their profession and not captivated by money. And, they bring nontraditional values and interests to the workplace (Glen, 2003).

A third basis for our research focus is the recognition that many of the companies relying on IT&T professionals have already identified the need for an unusual organizational culture and climate in order to attract and retain top producers. Several of these organizations make the notable CNNMoney list of the "100 Best Companies To Work For." The 2011 list (February 7, 2011 issue) includes SAS at the top, a privately held software company which has been on this list for 14 years and is notorious for its human resource management style. Other IT&T companies on the 2011 list include: Google, NetApp, Cisco, Qualcomm, Intuit, Intel, Salesforce.com, Adobe Systems, Microsoft, and Rackspace Hosting. The 2012 list (February 6, 2012 issue) drops SAS to third place and elevates Google to first. However the 2013 list ranks Google again at number 1 and SAS at number 2 (CNN Money, 2012 & 2013).

The purpose of our research is to explore the relationships among CSR and success measures in the IT&T industry. More specifically, we examine the relationships between employee relations, an aspect of social responsibility, and accounting measures of efficiency and financial success. In addition, we investigate the relationship of these CSR aspects with Tobin's Q, a measure of market success.

The remainder of this paper presents a review of the relevant literature, develops a model and states hypotheses, discusses the collection of data and methodology used in the study, presents the results along with implications of these results, recommends future research, and

finally, draws conclusions based on the research outcomes.

2. LITERATURE REVIEW

The literature review section first describes research surrounding the employee relations factor of CSR and its direct impact on measures of financial success. We also discuss the indirect relationship between an organization's culture and climate and how that influences employees' behaviors, ultimately impacting success measures. We then focus on research findings of studies investigating CSR and measures of performance that support our selection of proxies for success.

CSR and Employee Relations

CSR encompasses a multitude of activities. This is reflected in the various categories of the Kinder, Lydenberg, and Domini (KLD) database which provides data for researchers and investors. One of these categories, and our area of focus, is employee relations. The qualitative data provided by KLD for this aspect of CSR is frequently used to investigate activities from an internal stakeholder viewpoint. In relation to our research, other investigations have identified a direct link between employee relations and financial measures of performance. For example, Bird et al. (2007) included employee relations when determining what CSR activities are valued by the market. They found that being proactive in the employment area would be rewarded by the market. El Ghoul, Guedhami, Kwok, & Mishra (2011) also used the KLD database in their investigation of CSR's effect on the cost of capital in the banking industry. They found that employee relations, along with environmental performance and product characteristics, are the only CSR attributes that affect equity pricing.

CSR is reflected in an organization's culture and climate that in turn has been shown to have a significant relationship with numerous employee behaviors. These behaviors can indirectly impact an organization's measure of financial success. For example, Siu (2002) found organizational climate impacts job satisfaction and absenteeism, while Patterson, Warr, & West, (2004) found organizational climate to be related to productivity. Other studies have found relationships between climate and turnover intentions (Rentsch, 1990; Rousseau, 1990) and climate and organizational commitment (McIntyre, Battle, Landis & Dansby, 2002). Researchers have also explored specific professions and their organizational climate and culture. For example, Ross (2000) describes the relationship between organizational culture and the high rate of turnover for many people in software development and test positions. All these factors (job satisfaction, absenteeism, productivity, turnover, commitment) can ultimately impact a company's financial performance. Thus an organization's whose culture and climate supports the expectations of its employees might anticipate higher returns due to increased productivity, less absenteeism and turnover.

Measures of Financial Success and Efficiency

There are multiple means of measuring financial success of a company; however, we will focus on two: accounting measures of performance and market performance.

One very common accounting measure of financial success is a company's return on assets (ROA). ROA is calculated as net income divided by average total assets, and is an important measure of how well a company is using its assets to generate profitability (Kieso, Weygandt & Warfield, 2012). This ratio is a common measure of financial performance within the CSR literature (McGuire, Sundgren & Schneeweiss, 1988; Orlitzky, Schmidt & Rynes, 2003). It is also a common measure of firm profitability used in the information technology business value literature (Bharadwaj, 2000).

In addition to accounting measures of financial success we evaluate market performance. Tobin's Q has been found to be a superior predictor of real rates of return in the stock market (Harney & Tower, 2003; Orlitzky, Siegel & Waldman, 2011). Therefore, we use Tobins Q as our measure of market performance.

These accounting and market measures do not always coincide. As Thompson (2009) notes, there exists tension between financial performance goals, which are short-term in nature, and market performance goals, which are long-term. By investigating both, added insight is provided when attempting to determine the impact of CSR.

Another accounting metric is sales per employee (SPE). It is an efficiency metric considered to better measure performance of non-manufacturing companies (Periu, 2011; McClure

2009). SPE and particularly its trend over time provide information about how expensive a company is to run (McClure, 2009). Trend is particularly important, as new companies may reflect a low SPE, but over time the SPE should increase if the company is successful. SPE is particularly useful for measuring the efficiency compared to competitors for service-centered companies (McClure, 2009; CSIMarket, 2013). Comparison must be made within a particular industry however, as, for example, the ratio for retail companies will be very different than that for software companies (McClure 2009).

3. MODEL DEVELOPMENT

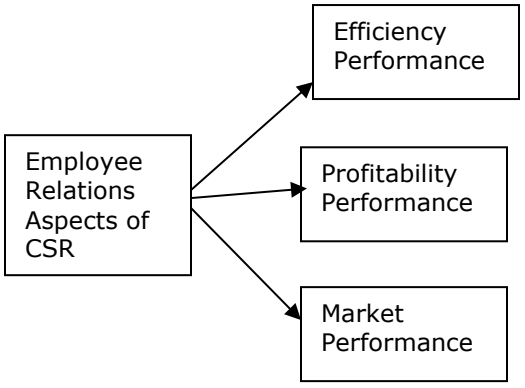

Figure 1.

Hypotheses

We propose and test three sets of hypotheses. All hypotheses are stated in the alternative. The first set of hypotheses identifies the relationship between employee relations and the productivity or efficiency of the firm. The second set addresses the relationship between accounting profitability measures and human resource practices. The final set of hypotheses addresses the relationship between market measures and human resource practices.

We posit the following hypothesis based on an efficiency measure of performance:

> $H1_1$: A significant positive relationship exists between employee relation strengths and accounting measures of efficient performance.

> $H1_2$: A significant negative relationship exists between employee relation concerns and accounting measures of efficient performance.

We posit the following hypotheses based on an accounting measure of profitability:

> $H1_3$: A significant positive relationship exists between employee relation strengths and accounting measures of profitability success.

> $H1_4$: A significant negative relationship exists between employee relation concerns and accounting measures of profitability success.

We posit the following hypothesis based on a market measure of performance:

> $H1_5$: A significant positive relationship exists between employee relation strengths and market measures of success.

> $H1_6$: A significant negative relationship exists between Employee Relation concerns and market measures of success.

4. DATA AND METHODOLOGY

In order to test the hypotheses, a study was designed which examines the relationships amongst measures of employee relations, profitability measures, efficiency measures, and market measures. The following section describes the data collection process, the variables used in the analysis, and the methodology employed.

Independent, Dependent, and Control Variables

This study uses panel data from the IT&T industry over the period 1999 through 2010. The dataset includes a total of 1217 observations with over 150 firms. We combine data from the Center for Research in Security Prices (CRSP) with the Socrates database from Kinder, Lydenberg, and Domini (KLD). The KLD Socrates database contains indicator variables for numerous categories of social performance. This database is used extensively in business ethics and socially responsible investing research; e.g., Hillman and Keim, 2001. The categories of CSR are: Community, Corporate

Governance, Diversity, Employee Relations, Environment, Human Rights, Product, and Controversial Business Issues. The last category encompasses companies with operations related to alcohol, gambling, tobacco, firearms, military, and nuclear power. Each category contains several indications of a strength or weakness (called a 'concern') relevant to the respective factors.

We develop two categorical variables by simply combining the KLD indicator ratings variables for company strengths listed under (EMPLOYEE_STRENGTHS), and the KLD indicator ratings variables that reflect concerns listed under (EMPLOYEE_CONCERNS). The indicator variables from the KLD database collapsed into employee strengths are seven employee relation variables: union relations, no-layoff policies, cash profit sharing, employee involvement, retirement benefits, health and safety, and other. The five employee relations concern variables include: union relations, health and safety, workforce reductions, retirement benefits, and other. Our samples included over 150 IT&T companies.

We are interested in investigating the relationship between both positive and negative employee relations and various measures of performance of the firm. The dependent variables used in the study represent accounting measures of efficiency, accounting measures of financial success and marketing measures of financial success. In particular, ROA and Total Sales per Employee are used to represent financial accounting profitability and efficiency, while Tobin's Q represents market performance.

In addition to the independent and dependent variables under investigation, control variables and lagged dependent variables are introduced. Serial correlation is a significant concern in this type of model. Therefore, we introduce lagged dependent variables to control for autocorrelation (i.e., SPE-1, SPE-2, ROA-1, ROA-2, Tobin's Q-2, Tobin's Q-3) in each of the equations. The number of periods is altered based on the highest lag of the dependent variable. Control variables which are found in the CSR literature are also introduced into the study. We control for cash flow using operating cash flow to assets (OPCF_TO_ASSETS). We control for research and development using research and development to sales (RD_TO_SALES). We control for leverage using the total long-term debt to equity ratio (TTL_LT_DEBT_TO_EQUITY). We control for size using the log of the number of employees (LOG_NUMB_EMP). All three models are estimated using common independent variables, but, as noted, using the required lagged dependent variables.

Table 1 provides descriptive statistics of the data acquired from the Center for Research in Security Prices (CRSP) and the Socrates database from Kinder, Lydenberg, and Domini (KLD). Of particular interest, the maximum number of employee strengths in the dataset is 4 and the mean employee strength is 0.26. No individual company had more than 2 employee concerns and the mean for this variable is 0.33.

Methodology

Since this study involves an investigation of the variables that serve as important discriminators of performance, we use a cross section, fixed effects ordinary least squares regression to model the relationships. The models for the accounting measures differ from the model for the market measure only in the timeframe of the variable measurement. We argue that accounting performance is dependent upon CSR activities that occur coincident with the accounting measure. We use standard measures of accounting performance; i.e., return on assets and total sales per employee. We use a proxy of our market performance measure. Tobin's Q is defined as the market value of the firm divided by the replacement value of the firm's assets. Given that we do not have replacement values, we proxy Tobin's Q with market value to book value. Thus, all the dependent variables and the independent CSR variables are measured at time t as depicted in Equations 1, 2 & 3.

Equation 1:

SPE = constant
+ Employee_Strengths
+ Employee_Concerns
+ SPE(-1)
+ SPE(-2)
+Operating Cash Flow to Assets
+ Research and Development to Sales
+ Total Long-Term Debt to Equity
+ Log of the Number of Employees

Equation 2:

ROA = constant
+ Employee_Strengths
+ Employee_Concerns
+ ROA(-1)

+ ROA(-2)
+ Operating Cash Flow to Assets
+ Research and Development to Sales
+ Total Long-Term Debt to Equity
+ Log of the Number of Employees

Equation 3:

Tobins Q = constant
+ Employee_Strengths
+ Employee_Concerns
+ TOBINSQ(-2)
+ TOBINSQ(-3)
+ Operating Cash Flow to Assets
+ Research and Development to Sales
+ Total Long-Term Debt to Equity
+ Log of the Number of Employees

We use a panel least squares methodology with period fixed effects to account for differences over time. We have an unbalanced panel as the available time series is not consistent across firms. The number of cross sections (firms) for each model also differs based on the elimination of observations due to lags.

All three models include period fixed effects. We test for fixed effects using both F-tests and Chi-Square tests. The tests are based on restricted specifications of the model; i.e., period fixed effects only and common intercept only. All tests strongly reject the null hypothesis that the fixed effects are redundant based on the test statistics and the corresponding p-values.

EVIEWS 7.0 software for time series analysis was used to calculate the results using panel least squares. No weighting was given to any particular variable.

5. RESULTS OF ANALYSIS

Our results for the efficiency measure of sales per employee (SPE) as the dependent variable are presented in Table 2. When SPE was used as the dependent variable the adjusted R-squared of the model was 0.83. This suggests that the independent CSR variables explain substantial changes in accounting performance. The Q-Stat calculations add credibility to the test indicating an insignificant amount of autocorrelation. The coefficient for Employee Strengths was positive and also significant at the 0.05 level. Because our independent variables (Employee Strengths and Employee Concerns) are a composite of categorical data, we are unable to interpret the resulting coefficient except for its direction. We can, however, conclude from this test that positive employee relation aspects of CSR do have a significant, positive impact on accounting measures of firm efficiency. The Employee Concerns variable, however, was not significant and the coefficient was neutral in this test.

When ROA is used as the dependent variable, the adjusted R-squared of the model is low (0.31), indicating that the explanatory power of the model is limited. However, the employee strengths coefficient was again positive and was significant at the 0.05 level. The employee concern coefficient was again not significantly different from 0. The Q-Stat calculations indicate autocorrelation is not significant in the equation.

Both of the above models support the rejection of the first and third null hypotheses indicating that a significant positive relationship exists between employee relation strengths and accounting measures of a firm's success. However, there is no evidence which would lead to the rejection of our second and fourth null hypotheses. Employee concerns do not appear to have a significant negative impact on accounting measures of success.

Table 4 contains regression results for Equation (3) that utilizes Tobin's Q as the market measure of performance. When Tobin's Q was used as the dependent variable, the adjusted R-squared of the model was 0.54. This suggests that the independent CSR variables explain more than half the changes in market performance. The Q-Stats and related p-values indicate that serial correlation is not a concern. The coefficient for the employee strengths variable was positive and also significant at the 0.05 level. The employee concerns variable coefficient was negative but was not significant. The analysis does support the rejection of our fifth null hypothesis under investigation. The results suggest that maintaining CSR through strong employee relations has a positive impact on a company's market performance. This aligns with the results presented by Harney and Tower (2003) and Orlitzky et al. (2011). However, the results of our analysis do not support the rejection of the sixth null hypothesis. There is no evidence that employee concerns within an organization have a negative impact on that firm's market performance.

6. IMPLICATION OF RESULTS

The results of this study have implications for information technology and telecommunications firms. There are, as is often the case, trade-offs between short-term and long-term effects of spending decisions. In general, decisions that save costs, thus increasing net income, all things being equal, improve financial standing as reflected in ROA. However, in regards to employee strengths and concerns, additional spending may actually improve the financial performance of companies in terms of accounting measures in the IT&T industry. Spending which is focused on establishing the desired organizational culture and climate and appropriate motivational mechanisms can impact financial performance positively. It is common knowledge that employee turnover can be costly; therefore, retaining employees with a fitting organizational atmosphere can save a company unnecessary recruiting, selection, and termination expenses. With a desirable culture and climate and fitting motivational processes, a company is also able to recruit the very best talent in the IT&T field. Spending to build strong employee relations as a component of CSR can actually decrease costs. SAS has long been a proponent of this philosophy and continues as an example of one of the most desirable places to work while continuously earning a profit. However, SAS has been a privately owned company which is not required to answer to stockholders in the short-run.

Trade-offs between short-term and long-term decisions are also incorporated into market price. Because the markets are forward-looking, we expect that CSR activities (anticipated or future behavior on the part of IT&T companies) to positively impact the prior year's Tobin's Q, our measure of market success. In other words, anticipated activity in the current period (time t) should be incorporated into market prices in the preceding period (time t-1). This rationale is consistent with previous research (Haney & tower, 2003; Orlitzky, Siegel & Waldman, 2011). Since employees are one of the most important "assets" for an IT firm, perceived abilities to attract and retain employees were expected to be viewed by investors positively. Our study did support this line of thought. Thus the positive impact on market performance which we anticipated from the employee relations portion of CSR is evident.

In summary, our study suggests a strong relationship between IT&T companies which enhance their corporate social citizenship through building strong employee relations and the accounting measures of success, SPE and ROA. This increase in accounting measures of performance was ultimately reflected in the market.

7. FUTURE RESEARCH

Our study focused on variables which captured union relations, layoff policies, cash profit sharing, employee involvement, retirement benefits, health and safety, and miscellaneous as a general measure of CSR in the employee relations arena. There are numerous measures of employee relations which can be used to expand this research. For example, investigating direct measures of organizational culture and climate with IT&T financial performance measures is encouraged. Or, various motivational techniques for personnel in the IT&T fields might be researched to determine the impact of accounting and market measures of success. Implications for the IT&T industry would also be forthcoming if research is more narrowly focused on each of the CSR variables individually to determine which, if any, has an impact on financial performance measures.

In addition to expanding and narrowing the number and type of independent variables impacting financial performance, research utilizing additional accounting and market measures is encouraged. Consistency amongst multiple measures of financial performance would provide an incentive or disincentive to companies in the IT&T industry to implement policies and procedures which directly impact employee relations.

8. CONCLUSIONS

Anecdotal evidence has long suggested that superior employee relations on the part of IT&T firms have led to superior performance. However, not all IT&T firms follow this pattern. Our objective in this study was to identify the relationship between various measures of firm performance and employee relations. We combine the data from the well-known KLD database with the CRSP data to conduct our investigation. We find very strong evidence to support that there is a positive relationship between affirmative employee relations and firm performance. Our results hold regardless of the

type of performance measure used; i.e., the results hold for profitability, efficiency and market measures. In contrast, we do not find evidence to support our hypothesis of negative outcomes associated with negative employee relations.

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APPENDIX

	Observations	Mean	Median	Maximum	Minimum	Std. Dev.
NET INCOME	1208	150.607	16.413	18760.000	-16198.000	1443.913
TOTAL ASSETS	1208	2361.213	463.670	92389.000	0.979	8159.112
TOTAL SALES	1208	1368.181	294.412	62484.000	0.036	4735.641
MARKET VALUE	1202	5765.959	819.648	422640.000	3.374	29607.670
BOOK VALUE	1208	1221.200	265.014	74825.000	-4734.000	5004.871
TOTAL LONG TERM DEBT	1191	223.757	0.149	11510.000	0.000	825.904
NUMBER OF EMPLOYEES	1199	5.523	1.445	126.000	0.002	12.598
OPERATING NET CASHFLOW	1207	332.725	38.913	24073.000	-3657.000	1718.825
RESEARCH & DEVEL EXPENSE	1070	192.433	40.916	9010.000	0.000	736.767
EMPLOYEE STRENGTHS	1217	0.256	0.000	4.000	0.000	0.554
EMPLOYEE CONCERNS	1217	0.329	0.000	2.000	0.000	0.521

***The number of observations differ based on missing data.**

Table 1. Descriptive Statistics

Dependent Variable: SALES PER EMPLOYEE (SPE)						
Method: Panel Least Squares						
Sample (adjusted): 2001 2010						
Periods included: 10						
Cross-sections included: 158						
Total panel (unbalanced) observations: 626						
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**		
C	25.71095	9.155635	2.80821	0.0051		
EMP_STR	6.125793	2.501126	2.449214	0.0146		
EMP_CON	1.895629	3.484625	0.543998	0.5866		
SPE(-1)	0.80254	0.081377	9.862015	0		
SPE(-2)	0.074825	0.073333	1.020349	0.308		
OPCF_TO_ASSETS	65.40194	29.5554	2.212859	0.0273		
RD_TO_SALES	-5.948369	21.31555	-0.279062	0.7803		
TTL_LT_DEBT_TO_EQUITY	-0.217209	0.477165	-0.455207	0.6491		
LOG_NUMB_EMP	-2.015755	1.750272	-1.151681	0.2499		
	Effects Specification					
Period fixed (dummy variables)						
R-squared	0.833291	Mean dependent var		244.7695		
Adjusted R-squared	0.82863	S.D. dependent var		94.33712		
S.E. of regression	39.05263	Akaike info criterion		10.19603		
Sum squared resid	927265.5	Schwarz criterion		10.32368		
Log likelihood	-3173.357	Hannan-Quinn criter.		10.24563		
F-statistic	178.7692	Durbin-Watson stat		2.046895		
Prob(F-statistic)	0					
Autocorrelation	**Partial Corr**		**AC**	**PAC**	**Q-Stat**	**Prob**
.|. |	.|. |	1	-0.039	-0.039	0.9732	0.324
.|. |	.|. |	2	0.006	0.005	0.9986	0.607
.|. |	.|. |	3	0.012	0.012	1.0844	0.781
.|. |	.|. |	4	0.038	0.039	1.993	0.737
.|. |	.|. |	5	0.012	0.015	2.0827	0.838
.|. |	.|. |	6	0.023	0.023	2.412	0.878
.|. |	.|. |	7	0.017	0.018	2.5929	0.92
.|. |	.|. |	8	0	0	2.593	0.957

TABLE 2. Least Squares Results for SPE as Dependent Variable

Dependent Variable: RETURN ON ASSETS (ROA)						
Method: Panel Least Squares						
Sample (adjusted): 2001 2010						
Periods included: 10						
Cross-sections included: 161						
Total panel (unbalanced) observations: 636						
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**		
C	0.037738	0.02474	1.52541	0.1277		
EMP_STR	0.01895	0.008854	2.140361	0.0327		
EMP_CON	0.00603	0.01284	0.469615	0.6388		
ROA(-1)	0.080139	0.039931	2.006947	0.0452		
ROA(-2)	-0.021367	0.01486	-1.437901	0.151		
OPCF_TO_SALES	0.377065	0.081616	4.619995	0		
RD_TO_SALES	-0.555071	0.13332	-4.163453	0		
TTL_LT_DEBT_TO_EQUITY	0.006865	0.004549	1.509119	0.1318		
LOG_NUMB_EMP	-0.005812	0.005399	-1.0766	0.2821		
	Effects Specification					
Period fixed (dummy variables)						
R-squared	0.325217	Mean dependent var		0.018823		
Adjusted R-squared	0.306655	S.D. dependent var		0.17068		
S.E. of regression	0.142121	Akaike info criterion		-1.03639		
Sum squared resid	12.48252	Schwarz criterion		-0.9103		
Log likelihood	347.5715	Hannan-Quinn criter.		-0.98743		
F-statistic	17.52058	Durbin-Watson stat		2.090285		
Prob(F-statistic)	0					
Autocorrelation	**Partial Corr**		**AC**	**PAC**	**Q-Stat**	**Prob**
.|. |	.|. |	1	0.017	0.017	0.1952	0.659
.|. |	.|. |	2	0.065	0.064	2.876	0.237
.|. |	.|. |	3	0.029	0.027	3.4176	0.332
.|. |	.|. |	4	0.04	0.036	4.4705	0.346
.|. |	.|. |	5	0.005	0	4.4837	0.482
.|. |	.|. |	6	0.005	0	4.5028	0.609
.|. |	.|. |	7	0.007	0.005	4.5354	0.716
.|. |	.|. |	8	0	-0.002	4.5355	0.806

Table 3. Least Squares Results for ROA as Dependent Variable

Dependent Variable: MARKET VALUE TO BOOK VALUE (TOBINSQ)						
Method: Panel Least Squares						
Sample (adjusted): 2002 2010						
Periods included: 9						
Cross-sections included: 127						
Total panel (unbalanced) observations: 468						
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**		
C	1.41224	0.338278	4.174791	0		
EMP_STR	0.429236	0.19757	2.172583	0.0303		
EMP_CON	-0.444579	0.275552	-1.613414	0.1074		
TOBINSQ(-2)	0.491576	0.079436	6.188336	0		
TOBINSQ(-3)	0.070774	0.062722	1.128384	0.2598		
OPCF_TO_SALES	0.574522	0.745924	0.770215	0.4416		
RD_TO_SALES	-3.39393	1.546122	-2.195125	0.0287		
TTL_LT_DEBT_TO_EQUITY	2.827113	0.428859	6.592174	0		
LOG_NUMB_EMP	-0.226141	0.114783	-1.970159	0.0494		
	Effects Specification					
Period fixed (dummy variables)						
R-squared	0.553013	Mean dependent var		3.662459		
Adjusted R-squared	0.537155	S.D. dependent var		4.288597		
S.E. of regression	2.917648	Akaike info criterion		5.015081		
Sum squared resid	3839.213	Schwarz criterion		5.165773		
Log likelihood	-1156.529	Hannan-Quinn criter.		5.074378		
F-statistic	34.87363	Durbin-Watson stat		1.649905		
Prob(F-statistic)	0					
Autocorrelation	**tial Correlation**		**AC**	**PAC**	**Q-Stat**	**Prob**
.|. |	.|. |	1	0.018	0.018	0.1462	0.702
.|. |	.|. |	2	0.019	0.019	0.3142	0.855
.|. |	.|. |	3	0.01	0.009	0.3569	0.949
.|. |	.|. |	4	0.008	0.008	0.3886	0.983
.|. |	.|. |	5	0.003	0.002	0.3929	0.996
.|. |	.|. |	6	0.001	0.001	0.3939	0.999
.|. |	.|. |	7	0	0	0.3939	1

TABLE 4. Least Squares Results for TOBINSQ as the Dependent Variable

Can Social Media aid Software Development?

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Abstract

Information technology professionals have been developing systems for over 50 years. Despite this wealth of experience, numerous problems continue to face software developers on the road to a successful implementation. In this paper, the authors examine how the use of social media systems and technologies could aid in the successful implementation of information systems. This is done by reviewing the systems development literature to identify the success factor addressing common problems that face software development teams, and on the use of social media. Then, the paper examines the social media systems that are available and shows how these social media systems could be used to alleviate the problems faced by software developers.

Keywords: Social Media, Systems Development, Systems Analysis and Design

1. INTRODUCTION

With the rise of companies like Facebook and Twitter, the use of social platforms and social media at work has received a great deal of popular press attention. As more and more people spend time on social media platforms compared to traditional media platforms, companies have realized the importance of social media for external communication. Companies have been exploring the use of these social platforms for marketing, customer contact, and the expansion of a company's "brand".

While it could certainly be argued that the extensive use of Facebook at work is outside the job description for most corporate jobs, it is possible that using platforms like this could help companies internally as well as externally. A number of companies have begun to at least explore, if not roll out, social media at work. Companies such as IBM, Cisco and SAP have been the leading proponents of social media use internally while a recent study found that half of the 290 companies surveyed use blogs and social networking for internal communication and collaboration. In fact, the argument for the use of social media in the workplace is much the same: it keeps employees more engaged in the running of the business.

One of the areas in which this technology could be particularly useful is in systems development. Despite the experience many organizations have with developing information systems, an alarming number of them still fail. Prior research has suggested there may be benefits to social media use during systems development. One study found use of social media by developers helped them to interact with other developers internally (Pan, 2008). Alternatively,

we have seen an increase in external developer sharing sites like Tweako and Reddit-Programming as well as many project manager turning to wikis or blogs (e.g. PMI's Wiki) to post questions or find solutions to project problems. However, there has been limited research examining how the various tools can be used together to lead to a successful development project. The literature in information systems development has identified a number of factors that can lead to the success, or failure, of new systems development projects.

The purpose of this paper is to examine the literature in both Systems Development and Social Media to see where the use of social media could aid systems development work.

2. LITERATURE REVIEW

As this paper focuses on both Systems Development and Social Media, each of these areas is examined separately in this section.

Systems Development

The literature stream on systems analysis and design and systems development is very deep. Indeed, this area of research stretches back to the beginning of the information systems literature.

However, the purpose of this paper is not to review the entirety of the systems analysis and design literature, but rather to examine those factors that have been identified as being critical to success. Even here, there have been a number of different studies performed (Brown, Chervany, & Reinicke, 2007; Ginzberg, 1981a, 1981b; Larsen, 2003). Based on common problems and issues found in development projects, these studies have identified several factors that are critical to the success of a new information systems project.

Collaboration

Collaboration between the development team and the business has been identified as a determinant of project success (De Cesare, Lycett, Macredie, Patel, & Paul, 2010). This concept ties back to one of the basic tenants of information systems development: involve the user.

Collaboration is even more important when agile methods are being used for software development (De Cesare, et al., 2010). In fact, agile methods are supposed to overcome some of the traditional problems with collaboration between the end users and the developers (Larman & Baili, 2003). Yet, there still remain collaboration issues in development projects.

Team Building

As much of the development work done today is team based, it is not surprising to find team building to be a success factor. Team building leads to task cohesion which in turn improves performance in information systems projects (Bahli & Buyukkurt, 2005). An important trend in software development that can impact this factor is the virtual organization.

The goal of the team is the same whether they are co-located, or spread across the globe. However, with virtual organizations, specific problems can arise for team building because of the physical distance between team members (Hughes, O'Brien, Randall, Rouncefield, & Tolmie, 2001).

Customer Satisfaction

Customer satisfaction is also important and leads to perceptions of software success (De Cesare, et al., 2010). This can be tied directly to the fact that systems "success" is frequently a perceptual variable: it's successful if I think it is.

On a related note, end user involvement has been identified as an important determinant to project success. The more involved the users feel they are in the development process, the more likely they are to have "buy in" for the final end product (Davis & Venkatesh, 2004). Additionally, the more involved they've been in the process, the more likely they are to be happy with the final product.

Communication

Communication is one of the key factors to the success of information systems projects (Brown, et al., 2007). This includes both communication within the development team, and between developers and business users. Communication includes both formal and informal channels among development team members as well as between the team and end users.

Communication and team involvement are particularly important factors with development using agile methods (De Cesare, et al., 2010; Nachamai, Vadivu, & Tapaskar, 2011). One

challenge with agile methods in the area of communications has been in the production of documentation. Agile methods are specifically focused on making software quickly with minimal documentation (Sircar, Nerur, & Mahapatra, 2001). As more companies move towards agile development, understanding how to maintain consistent communication with all parties involved will only increase in importance.

Commitment

It is important for members of the development team as well as business users be committed to the success of the project. Commitment to the success/vision of the project is frequently referenced as a key success factor (Basu, Hartono, Lederer, & Sethi, 2002; Brown, et al., 2007). However, commitment should not be limited to those directly engaged in the project. Support from top management to continue funding the project is at least as important. Without commitment from top management to see the project through to the end, the project will tend to fail.

Knowledge

As a success factor, knowledge is concerned with top management's knowledge of the technology involved (Basselier, Benbasat, & Reich, 2003; Brown, et al., 2007). Effectively, the more the managers know about how the technology can impact the organization, the more likely they are to understand and champion the project. Additionally, IT professionals need to have business acumen and knowledge from other parties involved in information systems development (Brown, et al., 2007).

Planning

The level of planning for the project is a direct link to success (Brown, et al., 2007; Byrd, Sambamurthy, & Zmud, 1995). For information systems, the more detailed the project plans are, and the more carefully they are monitored, the more likely the project is to succeed.

Infrastructure

While this may seem to be an obvious requirement for information systems success, infrastructure is far too often overlooked (Brown, et al., 2007; Larsen, 2003). The technical infrastructure of the firm is a major determinant of whether the project will be a success. The organization needs to have the ability to support the system on its hardware and networks. If this is not present, the system will fail.

Social Media Technologies

The use of social media has become a common practice for many individuals. Whether interacting with friends through Facebook or leveraging blogs to solve a problem, individuals are engaging with these technologies daily. A recent survey from the Pew Institute found that 67% of online adults use social networking sites (Duggan & Brenner, 2013), while another survey found that the average American Social Networking Site (SNS) user spends, on average, more than 3 hours a day on those sites (Wiltfong, 2013). Clearly, the use of social media has become pervasive; however this has not been limited to the public domain.

McAfee (2006) coined the term "Enterprise 2.0" to represent the use of publically available social media within the organizations. Since then, organizations have been looking for ways to leverage the benefits of social media in the workplace. This may include the purchase of a specific social media package from a vendor, or the use a publically available package (e.g. Facebook). No matter what approach is used, firms are bringing these technologies into the organizations. In fact, a recent survey conducted by McKinsey found that 65% of firms use some form of Web 2.0 technologies internally (Bughin, Chui, & Manyika, 2010). Of the Web 2.0 technologies employed at organizations, the most commonly used include social networking sites, wikis and blogs.

Social Networking Sites

Social networking sites are gaining increased popularity in the organization as a tool to support communication and collaboration. These sites are often designed to closely resemble public sites (e.g. Facebook) and are used for many of the same purposes, such as friending colleagues, creating group pages, maintaining relationships and sharing both personal and professional information about the profile owner (Joan DiMicco et al., 2008). When it comes to implementation, organizations may choose to purchase an internal site as part of a social media package or leverage a public site available only to employees by restricting who can join the organization "group" (Cummings, 2013). Research is continuing to grow in this area with much of the focus on how individuals manage their identity online (J. DiMicco & Millen, 2007) and how employees are actually

engaging in these sites (Joan DiMicco, et al., 2008).

Wikis

Wikis are 'a freely expandable collection of interlinked web pages, a hypertext system for storing and modifying information [and] a database, where each page is easily edited by any user' (Leuf & Cunningham, 2001). Organizations have approached the use of Wikis from two different perspectives: using an exclusively internal to the company (Enterprise Wiki) or engaging in external, publically available wikis (e.g. Wikipedia). Because companies and employees can appropriate these technologies as needed, wiki use is not limited to a single function but can be used for everything from general knowledge management to managing a specific project (for a summary of uses, see Stocker, Richter, Hoefler, & Tochtermann, 2012).

Blogs

Much like their public counterparts, corporate or internal blogs are designed to provide a space to share information and opinions through posts which provide an area to collaborate and share knowledge internally (Cho & Huh, 2010). Corporate blogs are created for various purposes within the organization, but can generally be categorized across the 5 different types listed in Table 1 (Lee, Hwang, & Lee, 2006). A more detailed examination of these blogs that are useful to development projects is included in the next section.

Table 1. Types of Corporate Blogs

Type	Description
Employee	Various content and format maintained by employees
Group	Focused around specific content maintained by a group of employees
Executive	Content created by corporate executives to communicate with employees
Promotional	Content centered on upcoming events or new/updated products
Newsletter	Content discussing company news or existing products

The availability and uses of these social technologies is continually expanding. In the current research, we examine the use of these technologies in overcoming the common issues facing development teams. Our goal is to provide a foundation for further exploration in the use of social technologies to aid in effective development projects. In the next section, we describe how each of the social media technologies discussed can aid in achieving the success factors previously discussed.

3. THEORY DEVELOPMENT

In this section, we will examine each of the identified factors associated with systems success (Collaboration, Team Building, Customer Satisfaction, Communication, Commitment, Knowledge, Planning and Infrastructure) and how social media could help. While social media has the potential to impact many of these factors, these technologies cannot resolve or alleviate problems found in all of these areas. In particular, social media has a limited to no impact on the technological infrastructure at firms. Thus, this factor will not be discussed further in the current research.

The impact of social technologies varies depending upon the factor being addressed. Table 2 provides an overview of the potential impact of different social media technologies on each critical success factor associated with software development projects. In the subsequent sub-sections, we examine each success factor in relation to the benefits it may receive from different social media technologies.

Table 2. Social Technology Solutions for Software Development

Factor	SNS	Wikis	Blogs
Collaboration	**X**	**X**	
Team Building	**X**		
Customer Satisfaction	**X**	**X**	
Communication	**X**	**X**	**X**
Commitment	**X**		**X**
Knowledge		**X**	**X**
Planning		**X**	

Collaboration

Collaboration is essential to every software development project given the number of parties commonly involved. Developers, managers, and end users must all work together from the

beginning of any software development project, and organizational social technologies can help with this in a number of different ways.
For example, while agile methods are frequently criticized for not developing documentation, a social media system may be able to help by providing documentation of discussions and design decisions made about a system in real time (e.g. discussions occurring in a blog). Thus, the social media system both assists in the process of collaboration between the many parties involved and can help to create some of the deliverables for the project in the process.

Wikis provide a centrally located repository for all information concerning a specific development project. Because of this central location, any parties needing to collaborate on a specific issue can be assured that the same information is viewed by all of those involved. Beyond document consistency, Wikis can track changes to understand who has been working on specific aspects of the projects. While this may not directly impact the actual coding, wikis do provide an advantage for end users communicating with developers.

For example, end users would be able to see the requirements they provided for a specific part of the software. This would allow them to track the changes coming with the new system as well as make adjustments to the initial requirements based on any errors they may see. Additionally, because wikis can be set with various user rights, developers can ensure that requirements must go through a formal process of approval on the wiki to maintain a structured review process.

Social networking sites can also provide an effective tool for collaboration among stakeholders in a development project. Groups can be created to allow stakeholders to have one location to communicate problems or pose concerns about a specific project. Because groups often contain the same functionality as profile pages (e.g. wall posts), members of that group are able to respond to posts or provide additional information when requested.

Team Building

Creating a strong, cohesive team is one of the most important factors in not only software development teams, but any organizational team. However, two of the challenges facing team members are diverse backgrounds and little knowledge concerning the other members of the team. This is exacerbated by the global nature of today's organizations, in which end users may be in one location while developers are in another.

One approach to alleviating these issues is building social capital within the group, thus creating a strong community in which collaboration exists and flourishes (Tsai & Ghoshal, 1998). Social capital is based on building a shared understanding among team members, creating trust across the team and developing an identity with those you work with (Nahapiet & Ghoshal, 1998). Prior research has suggested social networking sites as a potential technology to increase social capital among team members (Cummings, 2013).

Social networking sites create an environment where team members can learn more about who they are working with, often times before they meet face-to-face. SNS profile features available include past education, skills, hobbies, etc. providing team members a more detailed understanding of who they are working with. This creates an ideal environment for teams that are globally distributed and cannot take advantage of initial face-to-face meetings to build team cohesiveness.

Customer Satisfaction

As previously mentioned, customer satisfaction is most often affected by the level of end user involvement. As with collaboration, wikis enable end users to become more involved in the project. Through a project wiki, end users have the ability to track requirements, changes, and progress (Yang, Wu, Koolmanojwong, Winsor Brown, & Boehm, 2008). This allows the end user to become more involved in the process from beginning to end. Capturing end user satisfaction from the onset of a software project increases the likelihood of success (Davis & Venkatesh, 2004).

SNS groups provide an additional social component, enabling the feeling of involvement across all stakeholders. Through wall posts and project "groups", stakeholders remain up-to-date on progress and can answer any questions posted. This also provides a sense of belonging to the process which has been shown to increase satisfaction with the final product.

Communication

As with any project, communication is a key success factor that is often challenging to achieve across all stakeholders. The nature of social technologies, such as social networking sites, increases communication across all stakeholders as members of the site can connect and follow the progress of the development projects through the various features available in SNS (e.g. wall posts). These sites offer a synchronous environment in which communication can occur immediately between both parties involved. This is achieved through features such as instant messaging for immediate responses or wall posts for those communicating at different times.

Although not a traditional synchronous environment, wikis do provide an asynchronous tool that enables users of the site to post information through the wiki and make it publically available to anyone. Through the editing feature of the wiki, users will also be able to make corrections, add their comments or post concerns related to the project.

An alternative to using SNS for communication is an internal blog. The nature of blogs lends itself to software development projects, as they provide a chronological history of a specific project or executive. For example, the software development manager can create a blog to keep a chronological history of the project. Another blog commonly used in organizations is the group blog (Lee, et al., 2006). These blogs can be setup for a specific group or project which would be ideal for the software development team to continually communicate with one another as well as others viewing the blog.

Commitment

SNS create an environment in which stakeholders can both identify and bond with the development group. Social categorization (e.g. organizational membership) has been shown to increase feelings of commitment among team members (Ren, Kraut, & Kiesler, 2007). Being a member of a SNS "group" allows individuals to see themselves as being part of a collective group through social categorization while developing a common bond through the opportunity to exchange personal information (e.g. profile information). Research has shown that this identity-based attachment and bond-based attachment can increase positive feelings toward the group and increase commitment as well as the likelihood of remaining in the group (Levine & Moreland, 1998).

Another challenge to software development projects is top management commitment. When stakeholders do not feel commitment from the top, their commitment to the project often wanes (Basu, et al., 2002). Because of the hierarchy typically found in organizations, the opportunity to interact with top management is often limited. This creates a challenge for stakeholders, who need to get a sense of commitment from top management. Blogs, specifically executive blogs, enables top management to communicate with project stakeholders (Lee, et al., 2006). These types of corporate blogs allow executives and management to communicate corporate wide, enabling them to show their support and praise the work that is being done.

Knowledge

The more individuals know about how a system works, the more likely the project is to succeed. Thus, having management and other stakeholders (e.g. end users) understand other parts of the project and how their particular piece fits can provide a means of improving the likelihood of success for the entire software development project.

Blogs and wikis often play opposite roles in organizations where knowledge is concerned. While blogs are an individual voice, wikis provide a technology to capture many voices (Delio, 2005). Wikis provide an area in which the aggregate knowledge of project stakeholders can be captured and expanded on. This provides a push/pull model in which the pool of information increases as more users engage in the technology by adding new information and editing existing information (Phuwanartnurak & Hendry, 2009). This creates an environment where management can gain a clear perspective of the technology through available information or where IT professionals can ensure information is properly represented by others.

Beyond knowledge of the technology, wikis can also help future development projects at the same organization. Search functions within wikis enable teams working on future software development projects to learn from past projects. This could help projects to not only succeed but provide cost savings as well (e.g.

minimizes duplication of effort if code has already been written for previous projects). There are a number of sites currently available to developers in the public realm for those searching for code or development help. However, these provide general advice that may be different depending on the industry or organization. Internal Wikis could act as a repository to facilitate code reuse, allowing developers to search through what has been done in the past and how it could fit the current project. Whether including sections of code on the wiki or describing which development projects provided specific functionality, a wiki could act as a starting point for code reuse on new software development projects.

Blogs can also provide an area in which we can learn about the knowledge or skills of other employees. This could help management who may be unclear about a piece of technology find the appropriate person to aid in their understanding. For example, IBM provides BlogCentral to employees, which has been leveraged internally to learn more about what employees know throughout the company (Delio, 2005). Because of the search ability built into the system, individuals can search for others that may have the knowledge needed for a specific project that may not be represented in their SNS profile.

Planning

While social networking sites may help with coordination, wikis provide a more conducive tool to development project planning. As previously mentioned, wikis can serve as document management system during the initial stages of planning future developments(Raman, 2006). Furthermore, project activities can be centralized and captured through the wiki. Stakeholders can then create wiki pages for each project activity to include a main page with the activity plan, announcements, etc. (Xu, 2007). Not only is this useful for current projects, these wiki pages can serve as templates or starting points for future development projects.

4. CONCLUSIONS

The use of social media within organizations (whether internal packages or public sites) appears to be here to stay. Companies are still evaluating the importance of these technologies and how they can leverage them to meet the needs of their employees. We have provided a brief overview of how specific social media technologies (i.e. blogs, wikis and SNSs) can positively impact software development projects. Specifically, by examining key functions of development success, we identified how these technologies may be used to alleviate the most common problems found in information systems development projects.

As with any technology, organizations must evaluate what would work best within their environment. This is why the paper provides a few alternatives for each factor identified that can be used by organizations. Many companies have already implemented one or more of these social networking technologies, and there may be no need to implement additional ones, depending upon their specific needs.

This research is not intended to be an exhaustive examination of how social media can solve all problems found in software development projects. Additionally, there are a number of software development technologies that may prove useful aside from the technologies described in this paper. Rather, this research was written to open a conversation and provide some guidance on how these technologies can be applied to software development. Future research is needed to examine the links between development factors and social technologies discussed in this paper, and should include an examination of features beyond what is mentioned here to test their applicability to various software development projects.

While we have discussed the numerous potentially positive aspects of social technologies, organizations must still remain cautious about their implementation and approach to these technologies. The same social aspect of these technologies which provide benefits can also have negative consequences. Users need to be aware of the public nature of their posts which is often available to whoever has access to the technology. In other words, they need to be made aware that anyone who has access to these technologies will be able to view their comments.

Another important factor that must be considered when examining social networking technologies is deciding on the approach to implementing these technologies. For example, organizations must decide whether to allow

anyone to edit wikis, or to provide restrictions based on role. Decisions must also be made about how organizations want to approach an internal SNS. Should employers issue guidelines stating professional use only, or leave it up to the user to decide what is and is not appropriate? Should employers provide all the available features to users? These are just a few of the questions facing organizations rolling out an organizational social media strategy. Obviously, organizations should consider these questions carefully prior to rolling out social media to assist in software development projects.

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