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Factors Affecting the Adoption of Cloud Computing in the Government Sector: A Case Study of Saudi Arabia

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ABSTRACT

Cloud computing technology can play an important role in the public sector organisations since it decreases the cost of using information technology (IT) services and also has several other benefits. This paper aims to examine a range of factors affecting the cloud computing adoption by governments. In a case study of Saudi government organasations, a survey was conducted and four Saudi organisations participated in the study. The survey was theoretically designed based on the literature. An online survey was conducted and 169 respondents participated from different levels of an organisation. A quantitative analyses of the data were processed from descriptive and one-way frequency statistics to inferential and regression analysis. Nineteenth hypotheses were tested and key findings were that 85.80% of the respondents supported the adoption of cloud computing technology in their organisation, while 97.63% perceived its usefulness as the most important factor in adopting cloud computing. 95.26% of the respondents also perceived service quality and security as an important factor in the adoption of cloud computing. Inferential analyses show that the respondents who consider service quality as an important factor in the adoption of cloud computing have a statistically significant lower adoption attitude.

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1. INTRODUCTION

The cloud computing is a relatively new concept in the computing world and it represents to the emergence of a new computing paradigm [1, 2, 3]. Cloud computing has emerged as a potentially a major booming for the innovation of IT field [4]. The most widely used definition of cloud computing is:“ a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications, and services) that can be provided quickly and released with minimal management effort or service provider interaction“ [5].

The future of computing lies in Cloud computing technology, where the main objective is reducing IT costs while increasing productivity, availability, reliability, and flexibility and minimising the response times [6]. It has been reported by [7] that the majority of organisations from around the globe tend to invest 1 to 5 per cent of their revenue on IT infrastructure and many organisations spend huge sums of money on information system (IS) implementation projects. This is also true of the public sector.

One of the major issues faced by large government organisations is the amount of spent on IT infrastructure. Foe example, the government of Saudi Arabia spent around 4 billion GBP in 2010 and it is forecast that the total spending for the year subsequent might have increased by 10.2% compared to 2010 [7]. Actual spending on IT infrastructure is significantly slashed with the help of cloud computing, the organisations tend to be able to concentrate on their core business more which is very beneficial for all types of business. It has been observed that most organisations tend to pay for many more resources than they actually need and therefore it is better to utilize cloud computing so that organisations pay only for the resources they utilize [7].

A study conducted by Gartner [8] showed that in 2013 the IT executives and leaders considered the cloud computing technology to be one of the top five most valuable technologies. The spending on software as a service (SaaS) by 77% of IT budget at organisation was predicted to increase in the following two years. This would represent about 18% of public spending on computing technologies in the entire world. In 2017, the total spending will be about $134 billion [9]. Companies can source software solutions and computing infrastructure from the cloud on a temporary basis by using the technology, and cloud providers allow them access to their services over the network [10]. IT outsourcing can save money and provide access to technical information [8]. Resource efficiency, flexibility and risk transference are provided as well by cloud computing technology [11]. It also decreases the consumption of energy [12] due to the use of a combined configuration of the resources for computing, on-demand automatic scalability and the pay-per–need model of pricing [10].

Several factors have to be considered when making a decision about whether or not to implement cloud computing technology. If the technology is adopted without any research being conducted, it can be financially harmful for the firm. To make a correct decision, a government must consider all the factors involved, and this research provides a framework for making the correct decision.

Introduction to the experiences of other countries all over the world are discussed in the next sections in order to get the right picture about the state of cloud computing adoption in the developed and developing countries.

1.1. The State of Cloud Computing in UK Government

The British government has taken a realistic and rational approach in taking the necessary measures towards initiating the process of incorporating cloud computing processes into its operations so that ultimately all government functions would be interlinked [13], including the procurement processes of the various departments. Pursuant to the standards set by the Kasumigaseki Cloud, the British government plans to gradually implement a standardised cloud computing paradigm across all levels, while also ensuring that the corresponding operation and maintenance costs for the system are maintained at reasonable levels.

The government has therefore prioritised the creation of the "G-cloud" initiative, which is intended to demonstrate the importance of these plans [13]. The government has also commissioned a collaboration between the Departments for Business Innovation and Skills and Culture, Media and Sport to issue the Digital Britain Report in June 2009, so that the official policy in this regard is publicly presented to all stakeholders, with Prime Minister Gordon Brown officially stating that "The Digital Britain initiative is an extension of our attempt to empower the coming generations with a robust economy" [14].

1.2. The State of Cloud Computing in Other Countries

Realising the potential benefits and cost savings associated with the adoption of cloud computing initiatives, governments around the world are scrambling to incorporate the technology in their operations. The United States government is at the forefront of this effort, as demonstrated by the Federal Chief Information Officer(CIO's) conclusion that cloud computing initiatives have strategic value for the country. Testifying before the House Committee on Oversight and Government Reform, the CIO contended that "The current President is definitely on track in its initiative to ensure that the benefits of cloud computing are made available to all sectors of the American population" [15].

Cloud computing technologies have already been used by employees at numerous federal agencies and their associated offices for quite a while [16]. However, by habit and default, the government has been averse to allowing their employees to utilise such technologies so openly and frequently, especially in the execution of their official duties and responsibilities. At present, the cloud computing initiatives of the federal government have been initiated and implemented in the spheres of information exchange and communication across multiple government agencies and bodies, which constitutes the SaaS (Software as a Service) layer [17].

The Japanese government has initiated the "Kasumigaseki Cloud" initiative, named after the business district in the city where the bulk of government offices are located [18], with the intention that a single private cloud would host the infrastructure for all the associated government offices [19]. Such a structure is intended to provide for the rationalisation of all systems across all levels of the government functions to be conducted by the Japanese Ministry of Internal Affairs and Communications [20], besides making it easy to maintain and cater to the clients. Such a strategy is intended to provide the dual benefit of easy maintenance of the system, and also a "green" IT infrastructure [21] whereby the Kasumigaseki Cloud, which is part of the 100 trillion yen Digital Japan Creation Project, would create thousands of new IT jobs to revitalise the economy, and it would double the domestic IT market by 2020 [22].

The Info Communication Development Authority (IDA) in Singapore also attaches significant importance to cloud computing, realistically recognising it to be the future of IT and communication networks in the coming ages

[18]. The IDA's research-based "Open Cirrus" cloud project has partnered with prominent and international firms of global repute, including HP and Yahoo, to implement this initiative and progress the IT network in the island nation.

While the Chinese government has yet to undertake a national cloud computing initiative, local and regional governments are all too aware of the benefits offered by the process, and are forging ahead with IBM in developing cloud computing infrastructure for their areas. The regional government in Dongying, in the north of the country, is developing a cloud computing solution towards implementing its e-government initiative through the Yellow River Delta Cloud Computing Centre. Mr. Li Jinkun, the vice-mayor of the city, has labelled the effort as a drive to "become a 'city of digital innovation'". Similarly, Wuxi in South Eastern China has set up a government-funded "cloud services factory" where all small start-up companies in the area can access the services offered by this initiative, leading to access to state-of-the art IT infrastructure at very affordable costs. Considering the funding constraints inevitable with new businesses, this initiative is intended to provide indirect funding to businesses by helping ease up funds for other activities, while the IT infrastructure is handled by local government through this initiative [23].

The government Information Technology Service (GITS) in Thailand is in the process of setting up a cloud for government services to offer SaaS services, having already established a centralised platform for web-based e-mail services. Such rationalisation will go towards increasing service levels for the population, besides cutting down "considerably" on corresponding and associated costs [18].

The Ministry of Commerce in New Zealand is setting up studies on how cloud computing and SaaS can benefit and streamline the functioning of the government, while simultaneously revamping IT procurement processes for the government. The "centres of expertise" effort in this regard is intended to benefit all stakeholders so associated [24].

The Vietnamese government has teamed up with IBM to explore and create cloud computing solutions for its government and education sectors while it moves towards rapid industrialisation [25]. Willy Chiu from the IBM Cloud Labs in the country has made the observation that "the government is about the perception that it could utilise cloud computing interfaces to boost and revive the services sector" [26].

1.3. The State of Cloud Computing in Saudi Arabia

In Saudi Arabia, cloud computing efforts are being initiated by the two publicly traded, government-owned and operated telecommunications companies. Starting in 2010, these firms have begun to explore how they could offer their services to the corporate and financial sectors in the country using cloud technology.

A primary concern in the Saudi corporate sector is the availability of a low-cost data recovery mechanism to ensure that businesses do not needlessly suffer in the case of breakdowns in existing processes. Accordingly, the telecoms companies are working to fill this void at the present moment [27]. However, overall, there is no clear partly due to initiative to implement any cloud computing solutions in the government sector, considering the overly bureaucratic structure of the multiple layers and sectors of the existing government machinery. Experts are of the opinion that perhaps a major push from someone in a position of authority is a prerequisite before the Saudi government would take the necessary and required action to explore the inherent benefits to stakeholders offered by cloud computing [27].

A global market advisory firm, the International Data Corporation (IDC), is of the opinion that the traditional mindset of the Saudis, emphasising security concerns about allowing external businesses to handle a firm's processes, could be a major factor hindering the growth of cloud computing technologies. Clearly, this would involve a major outsourcing exercise involving external business partners offering managed services. However, progress is being made and current statistics indicate that outsourcing segment has exhibited a 16.3% increase during 2014, while the corresponding overall IT services market overall expanded by 13.9%. IDC also offered the insight that investments and expenditures in cloud computing services would exhibit a healthy 52.9% surge even if the current levels of investment are at very low figures [28].

In line with global business trends, and to be competitive in the global marketplace, Saudi organisations have to be responsive to current needs by being more agile, increasing workplace efficiency and standardising on IT functions. Correspondingly, making inroads in these areas requires businesses to embrace virtualisation, cloud computing, and analytics. Realising the present gap, Saudi businesses are gradually responding to the market-driven needs and are now mentally prepared for the inevitable outsourcing of their IT functions while they focus on their core business. Considering the potential inherent in cloud computing and the realisation of Saudi companies of the need to use this technology, the telecoms providers working on groundbreaking work to provide this technology are making significant investments to develop a range of options for their clients. The International Data Corporation (IDC) has observed that while Saudi companies, obsessed with security in the fast moving Middle East, are reluctant to make the transition to fully operational cloud computing interfaces. However, as awareness builds and companies are made increasingly aware of the benefits and security inherent in even the most public of cloud computing interfaces, companies are expected to sign up for the experience and thereby partake of the "true" cloud computing experience which would definitely include aspects of automation, metering, chargeback and all such features [28].

1.4. Theoretical Background

There is a number of theories and models of "information system innovation adoption" have could be employed to form the theortical background and the conceptuial model of this study. There were selected theories and a model that forms the conceptual model of this study. Tornatzky and Fleischer (1990) presented the TOE (technology-organisation-environment) framework in which the particular firm context of the organizational adoption decision-making procedure is discussed. This framework does not act as a distinct model for determinants; rather it offers a classification through which the factors that aid or hamper the adoption and execution of IT-based innovations are categorized in organizations by keeping in view their respective organizations, technological or environmental context. IS researchers have employed the TOE framework to a large extent, for instance, to study the organizational adoption of e-business [29, 30], open systems [31] and Internet use [32], and this is the reason that the TOE framework was used in this study. In addition, Iacovou et al. (1995) found it to be relevant and applicable for categorizing cloud computing adoption factors.

The TOE framework comprises of a sound theoretical structure, and includes practical sustenance, and the probable submission to IS implementation [33]. The TOE framework comprises of the environmental framework, it enhances the ability to describe intra-corporation invention implementation; hence, we observe that this model is most suitable and comprehensive. According to the readings, of context, of IT implementation models at business level, frequent observed readings are found within the DOI (Diffusion-of-Innovation) theory and the TOE framework. Therefore, an elaborated study of the TOE framework took place to understand empirical studies that only practice the TOE framework, and empirical findings connect this model to the Iacovou et al. (1995) model, and highlights that similar framework in a particular theoretical framework can possess dissimilar factors. Consequently, this study applies two TOE and Iacovou et al. (1995) model to get improved knowledge, to determine the most suitable Cloud computing adoption factors.

This study concentrates on the factors that influence the adoption of cloud computing by carrying out an evaluation at the organizational level. The drivers of organizational adoption and cloud services can be assessed holistically by using a theoretical model that takes into account the various aspects of cloud computing as well as the wider context in which this innovation is carried out.

1.5. Research Model and Hypotheses

Based on the literature, a number of hypotheses are tested in this study, concerning factors which have been established as critical predictors of technology adoption. Fig. 1 illustrates the proposed model for cloud computing adoption in Saudi Arabia and shows the relationship between the independent and dependent constructs. The research hypotheses are as follows:

H1: Service quality has a positive and significant effect on cloud computing adoption. H2 : Usefulness will have a positive and significant effect on cloud computing adoption. H3 : Security concern will have a positive and significant effect on cloud computing adoption. H4 : Complexity will have a negative and significant effect on Cloud computing adoption. H5 : Cost will have a positive and significant effect on cloud computing adoption. H6 : Organization size will have a positive and significant effect on Cloud computing adoption. H7 : IT Infrastructure readiness will have a positive and significant effect on cloud computing adoption. H8 : Feasibility will have a positive and significant effect on cloud computing adoption. H9 : Trust will have a positive and significant effect on Cloud computing adoption. H10: Organization culture will have a negative and significant effect on cloud computing adoption. H11: Organization structure will have a positive and significant effect on cloud computing adoption. H12: Privacy risk will have a positive and significant effect on cloud computing adoption. H13: Government support will have a positive and significant effect on cloud computing adoption. H14: Regulatory concern will have a negative and significant effect on cloud computing adoption. H15: External pressure will have a positive and significant effect on cloud computing adoption. H16: Culture will have a negative and significant effect on cloud computing adoption. H17: Industry type will have a positive and significant effect on cloud computing adoption. H18: Direct benefits will have a positive and significant effect on cloud computing adoption. H19: Indirect benefits will have a positive and significant effect on cloud computing adoption.

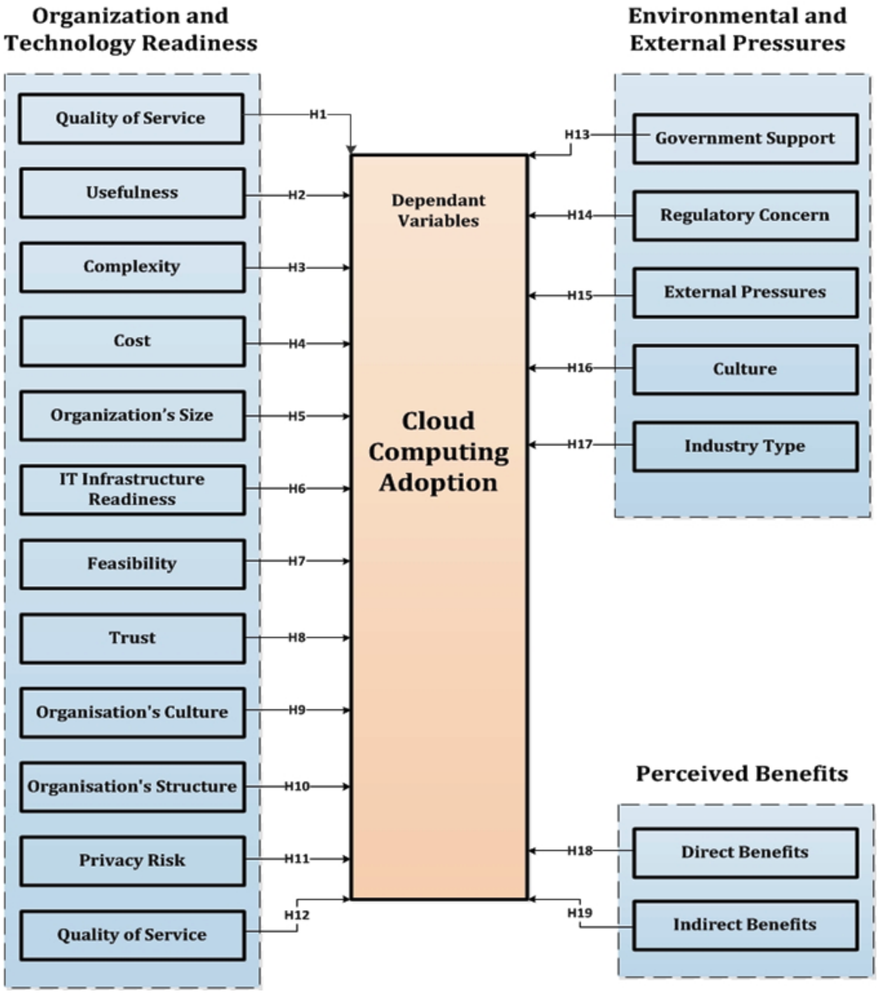

Figure 1. Research model of Cloud Computing Adoption in the Public Sector

2. RESEARCH METHOD

A multiple case study, survey-based study was conducted in four Saudi government organizations. The study has been divided into three stages. The first stage focuses upon definitions the relevant literature along with the factors which affect the adoption of cloud. The second stage of the study describes a survey conducted through a set of questionnaire in order to collect primary data. Finally, descriptive and inferential statistics are employed to analyse the data gathered.

2.1. Questionnaire Development

A web-based survey was conducted to collect quantitative data in order to test the potential predictive power of selected variables on cloud computing adoption. The survey instrument was developed and pilot-tested by the authors of this study. A five-point Likert-type scales were used for responses to the survey items. The 19 variables highlighted would be able to cover several factors and aspects which need to be presented throughout the research process.

Clear and brief instructions were provided to the respondents to make sure that all participants clearly understand the instructions of the survey. The nature of the research study was explained to the respondents through a covering letter provided with the questionnaire. They were instructed not to include their names in the questionnaire responses since their identities would not be disclosed. They were also assured that the information they gave would remain confidential.

Leading organizations in Saudi Arabia were chosen and copies of the questionnaires were sent to these organizations to get participated in the study. The main instruments used in the web-based questionnaire were Dichotomous Questions and the five-points Likert-Scale. Demographic background, viewpoints related to were to be attained which is why the questionnaire was divided into various sections. The entire questionnaire was designed and distributed in the Arabic language, containing 34 closed format questions and 190 questionnaires was distributed out of which 169 responses were received.

2.2. Analysis Methods

Descriptive statistics were first employed to present the data, wherein information, facts and figures related to averages, central tendencies, distributions and measures of normality are all conveniently and easily explained in either tabular or graphical interfaces. The methodology goes on to describe and explain the parameters utilised in the research, which goes on to explain how the respondents have acknowledged the questionnaire, exhibiting the general trends against parallel subsets of answers received towards an initial analysis of the data before subjecting it to a more rigorous examination.

Selective sampling was conducted with the employees of various government organisations. The analysis of the data obtained from the survey involved two key processes. The first was the tabulation of the quantitative survey data using Microsoft Excel software. The second process consisted of the coding of the quantitative responses which were then statistically analysed using SPSS. The analysis plan highlighted the primary research questions in deference to the questionnaire items. Nineteen variables were classified as key variables and therefore it was important to conduct a cross-tabulation between these variables and data on the adoption of cloud computing. The quantitative analysis of the data proceeded from descriptive and one-way frequency statistics to inferential and regression analysis.

3. RESULTS AND DISCUSSION

3.1. Preliminary Analysis

This section presents the descriptive statistics of each variable measured using responses to the cloud computing adoption survey. The study involved a total of 190 participants, but, after eliminating data entry and respondent errors leading to missing, incomplete and invalid responses during the coding process, the total number of valid responses decreased to 169.

3.2. Personal Information

This section explores the frequencies and descriptive statistics of responses to the personal information questions presented in the survey. Coding was conducted using a template which highlights the upcoding rules and categories that summarise the data. The data are treated as ordinal non-parametric data since it is a measurement of the responses of the ranks and categories within the sample population (see Table 1).

Table 1. Frequency Statistics (n=169)

		Job Title	Education Level	Organisational Sector	No. Of Employees
N	Valid	169	169	169	169
	Missing	0	0	0	0
Mean		4.01	2.45	2.29	3.27
Median		4	3	2	4
Mode		3	3	1	4
Std. Deviation		1.516	0.779	1.152	1.066
Skewness		-0.02	-0.98	0.336	-1.147
Std. Error of Skewness		0.187	0.187	0.187	0.187
Kurtosis		-1.032	-0.643	-1.326	-0.159
Std. Error of Kurtosis		0.371	0.371	0.371	0.371
Range		5	2	3	3
Minimum		1	1	1	1
Maximum		6	3	4	4

From the descriptive statistics of the data on personal information, the group means which indicate the central tendency (normal) of the groups are centred towards IT Consultant for Job Title, Master's Degree for Education Level, Military Organisation for Organisational Sector, and "1000-5000" as the number of employees in the organisation. The standard deviation reveals that Job Title (SD = 1.516) has the highest variation in the distribution of responses while Education Level (SD = 0.779) includes narrowly spread observations. This evaluation is underscored by the high range of the Job Title variables (R=5) and low range of Education Level (R = 2). The skewness of almost all the groups is negative which indicates that the responses in the respective distributions are significantly clustered on the right-hand side of the arithmetic mean, with extreme responses occurring on the left of the mean resulting in a longer left-hand tail. On the other hand, organisational sector distribution is positively skewed, suggesting that the responses were clustered on the left side of the arithmetic mean, with extreme responses occurring on the right side of the mean which is evidenced by a longer right-hand tail.

3.3. Inferential Analysis

This section applies inferential statistical methods in order to develop conclusions concerning the implications of the data obtained in the responses to the cloud computing adoption survey. In particular, this section applies inferential statistics in order to make assumptions about the perceptions and attitudes towards cloud computing technology by the population from the sample data. In addition, inferential statistics are used to identify the probability that the observed differences identified using the descriptive statistics of the study are dependable or could occur by chance. While descriptive statistics simply describe variations in the data, inferential statistics enable the development of reliable generalisations from the data to the general population represented by the sample.

3.4. T-Test Analysis

The T-test analysis have been conducted to test the hypotheses and examine the significance of the factors predicted to affect the adoption of cloud computing. The results show that the values of the statistics for the nineteen factors have a P value of less than 0.005, which means that they all have a significant effect on adoption of cloud computing (see Table 2).

Table 2. T-test Analysis

	Levene's Test for Equality of Variances		T-test for Equality of Means						
Adoption Attitude								95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Equal variances assumed	9.342	0.003	-6.407	167	0	-0.839	0.131	-1.1	-0.58
Service Quality			-28.82	160	0	-0.839	0.029	-0.9	-0.781
Usefulness			-27.17	164	0	-0.818	0.03	-0.88	-0.759
Security Concern			-28.82	160	0	-0.839	0.029	-0.9	-0.781
Complexity			-27.95	162	0	-0.828	0.03	-0.89	-0.77
Cost			-61.26	139	0	-0.964	0.016	-0.99	-0.933
Organisation Size			-7.677	78	0	-0.43	0.056	-0.54	-0.319
IT Infrastructure			-16.07	38	0	-0.872	0.054	-0.98	-0.762
Feasibility			-20.2	36	0	-0.919	0.045	-1.01	-0.827
Trust			-56.13	140	0	-0.957	0.017	-0.99	-0.924
Organization Size			-35.58	150	0	-0.894	0.025	-0.94	-0.844
Organisation Structure			-10.68	47	0	-0.708	0.066	-0.84	-0.575
Privacy Risk			-29.3	159	0	-0.844	0.029	-0.9	-0.787
Government Support			-28.37	161	0	-0.833	0.029	-0.89	-0.775

Regulatory Concern		-10.2	49	0	-0.68	0.067	-0.81	-0.546
External Pressure		-8.692	60	0	-0.557	0.064	-0.69	-0.429
Culture		-32.24	154	0	-0.871	0.027	-0.92	-0.818
Industry Type		-78.52	137	0	-0.978	0.012	-1	-0.954
Direct Benefit		-10.68	47	0	-0.708	0.066	-0.84	-0.575
Indirect Benefit		-95.81	136	0	-0.985	0.01	-1.01	-0.965

3.5. Testing the Hypotheses: Regression Analysis

H1: Service quality has a positive and significant effect on cloud computing adoption.

Regression Statistics		**ANOVA**					
MultipleR	0.4441a		*df*	*SS*	*MS*	*F*	*Sig.F*
RSquare	0.197	*Regression*	1.000	5.359	5.350	41.040	0.000
AdjustedRSquare	0.192	*Residual*	167.000	21.801	0.130		
StandardError	0.361	*Total*	168.000	27.160			
Observations	169.000						

	Coefficients	*St. Error*	*t Stat*	*P-value*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.323	0.140	2.309	0.022	0.047	0.599
Service Quality	0.839	0.131	6.407	0.000	0.580	1.097

Based on the positive value (0.84) of the beta statistic as well as the p-values of the t and F-statistics at a 5% level of significance, the linear regression model confirms H1 that service quality has a positive and significant effect on the adoption of cloud computing. The value of R square implies that service quality can explain19.7% of the variation in cloud computing adoption.

H2: Usefulness has a positive and significant effect on cloud computing adoption.

Regression Statistics		**ANOVA**					
MultipleR	0.310		*df*	*SS*	*MS*	*F*	*Sig.F*
RSquare	0.096	*Regression*	1.000	2.614	2.614	17.787	0.000
AdjustedRSquare	0.091	*Residual*	167.000	24.545	0.147		
StandardError	0.383	*Total*	168	27.160			
Observations	169						

	Coefficients	*St. Error*	*t Stat*	*P-value*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.364	0.201	1.811	0.072	−0.033	0.760
Usefulness	0.818	0.194	4.217	0.000	0.435	1.201

Based on the positive value (0.82) of the beta statistic as well as the P-values of the t and F-statistics at a 5% level of significance, the linear regression model confirms H2 that usefulness has a positive and significant effect on cloud computing adoption. The value of R square implies that usefulness can explain 9.6% of the variation in cloud computing adoption.

H3: Security concerns have a positive and significant effect on cloud computing adoption.

Regression Statistics		**ANOVA**					
MultipleR	0.444		*df*	*SS*	*MS*	*F*	*Sig.F*
RSquare	0.197	*Regression*	1	5.359	5.359	41.047	0.000
AdjustedRSquare	0.192	*Residual*	167	21.801	0.131		
StandardError	0.361	*Total*	168	27.160			
Observations	169						

	Coefficients	*St. Error*	*t Stat*	*P-value*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.323	0.140	2.309	0.022	0.047	0.599
Security Concern	0.839	0.131	6.407	0.000	0.580	1.097

Based on the positive value (0.84) of the beta statistic as well as the p-values of the t and F-statistics at a 5% level of significance, the linear regression model confirms H3 that security concern has a positive and significant effect on cloud computing adoption. The value of R square implies that security concern can explain1 9.7% of the variation in cloud computing adoption. This also validates the correlation identified between service quality and security concern.

H4: Complexity has a positive and significant effect on cloud computing adoption.

Regression Statistics		**ANOVA**					
$MultipleR$	0.382		*df*	SS	MS	F	$Sig.F$
$RSquare$	0.146	$Regression$	1	3.970	3.970	28.586	0.000
$AdjustedRSquare$	0.141	$Residual$	167	23.190	0.139		
$StandardError$	0.373	$Total$	168	27.160			
Observations	169						

	Coefficients	*St. Error*	*t Stat*	*P-value*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.344	0.163	2.108	0.036	0.022	0.665
Complexity	0.828	0.155	5.347	0.000	0.522	1.134

Based on the positive value (0.83) of the beta statistic as well as the p-values of the t and F-statistics at a 5% level of significance, the linear regression model rejects H4 that complexity has a negative and significant effect on cloud computing adoption. The value of R square implies that complexity can explain 14.% of the variation in cloud computing adoption.

H5: Cost will have a positive and significant effect on cloud computing adoption.

Regression Statistics		**ANOVA**					
$MultipleR$	0.907		*df*	SS	MS	F	$Sig.F$
$RSquare$	0.822	$Regression$	1	22.338	22.338	773.734	0.000
$AdjustedRSquare$	0.821	$Residual$	167	4.821	0.029		
$StandardError$	0.170	$Total$	168	27.160			
Observations	169						

	Coefficients	*St. Error*	*t Stat*	*P-value*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.071	0.043	1.674	0.096	-0.013	0.156
Cost	0.964	0.035	27.816	0.000	0.896	1.033

Based on the positive value (0.96) of the beta statistic as well as the p-values of the t and F-statistics at a 5% level of significance, the linear regression model confirms H5 that cost has a positive and significant effect on cloud computing adoption. The value of R square implies that cost can explain 82.2% of the variation in cloud computing adoption.

H6: Size of organisation will have a positive and significant effect on cloud computing adoption.

Regression Statistics		**ANOVA**					
$MultipleR$	0.536		*df*	SS	MS	F	$Sig.F$
$RSquare$	0.287	$Regression$	1	7.793	7.793	67.195	0.000
$AdjustedRSquare$	0.283	$Residual$	167	19.367	0.116		
$StandardError$	0.341	$Total$	168	27.159			
Observations	169						

	Coefficients	*St. Error*	*t Stat*	*P-value*	*Lower 95.0%*	*Upper 95.0%*

Intercept	0.570	0.081	7.000	0.000	0.409	0.730
Organization Size	0.430	0.052	8.197	0.000	0.327	0.534

Based on the positive value (0.43) of the beta statistic as well as the p-values of the t and F-statistics at a 5% level of significance, the linear regression model confirms H6 that organization size has a positive and significant effect on cloud computing adoption. The value of R square implies that organization size can explain 28.7% of the variation in cloud computing adoption.

H7: IT infrastructure readiness will have a positive and significant effect on cloud computing adoption.

Regression Statistics		**ANOVA**					
MultipleR	0.916		*df*	*SS*	*MS*	*F*	*Sig.F*
RSquare	0.840	*Regression*	1	22.801	22.800	873.538	0.000
AdjustedRSquare	0.839	*Residual*	167	4.359	0.026		
StandardError	0.162	*Total*	168	27.160			
Observations	169						

	Coefficients	*St. Error*	*t Stat*	*P-value*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.128	0.038	3.341	0.001	0.052	0.204
IT infrastructure	0.872	0.029	29.556	0.000	0.814	0.930

Based on the positive value (0.87) of the beta statistic as well as the p-values of the t and F-statistics at a 5% level of significance, the linear regression model confirms H7 that IT infrastructure readiness has a positive and significant effect on cloud computing adoption. The value of R square implies that IT infrastructure readiness can explain approximately 84% of the variation in cloud computing adoption.

H8: Feasibility will have a positive and significant effect on cloud computing adoption.

Regression Statistics		**ANOVA**					
MultipleR	0.948		*df*	*SS*	*MS*	*F*	*Sig.F*
RSquare	0.898	*Regression*	1	24.403	24.403	1478.296	0.000
AdjustedRSquare	0.898	*Residual*	167	2.757	0.017		
StandardError	0.128	*Total*	168	27.160			
Observations	169						

	Coefficients	*St. Error*	*t Stat*	*P-value*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.081	0.031	2.636	0.009	0.020	0.142
Feasibility	0.919	0.024	38.449	0.000	0.872	0.966

Based on the positive value (0.92) of the beta statistic as well as the p-values of the t and F-statistics at a 5% level of significance, the linear regression model confirms H8 that feasibility has a positive and significant effect on cloud computing adoption. The value of R square implies that feasibility can explain approximately 90% of the variation in cloud computing adoption.

H9: Trust will have a positive and significant effect on cloud computing adoption.

Regression Statistics		**ANOVA**					
MultipleR	0.888		*df*	*SS*	*MS*	*F*	*Sig.F*
RSquare	0.790	*Regression*	1	21.415	21.415	622.544	0.000
AdjustedRSquare	0.787	*Residual*	167	5.745	0.034		
StandardError	0.185	*Total*	168	27.160			
Observations	169						

	Coefficients	*St. Error*	*t Stat*	*P-value*	*Lower 95.0%*	*Upper 95.0%*

Intercept	0.085	0.047	1.813	0.070	−0.008	0.178
Trust	0.960	0.038	24.951	0.000	0.882	1.033

Based on the positive value (0.96) of the beta statistic as well as the p-values of the t and F-statistics at a 5% level of significance, the linear regression model confirms H9 that trust has a positive and significant effect on cloud computing adoption. The value of R square implies that trust can explain approximately 79% of the variation in cloud computing adoption.

H10: Culture of organisation will have a positive and significant effect on cloud computing adoption.

Regression Statistics		**ANOVA**					
MultipleR	0.688		*df*	*SS*	*MS*	*F*	*Sig.F*
RSquare	0.473	*Regression*	1	12.855	12.855	150.078	0.000
AdjustedRSquare	0.470	*Residual*	167	14.305	0.086		
StandardError	0.293	*Total*	168	27.160			
Observations	169						

	Coefficients	*St. Error*	*t Stat*	*P-value*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.212	0.084	2.528	0.012	0.046	0.377
Organisation Culture	0.894	0.073	12.251	0.000	0.750	1.038

Based on the positive value (0.89) of the beta statistic as well as the p-values of the t and F-statistics at a 5% level of significance, the linear regression model rejects H10 that organization culture has a negative and significant effect on cloud computing adoption. The value of R square implies that Organisation Culture can explain 47.3% of the variation in cloud computing adoption.

H11: Structure of organisation will have a positive and significant effect on cloud computing adoption.

Regression Statistics		**ANOVA**					
MultipleR	0.797		*df*	*SS*	*MS*	*F*	*Sig.F*
RSquare	0.635	*Regression*	1	17.243	17.243	290.380	0.000
AdjustedRSquare	0.633	*Residual*	167	9.917	0.059		
StandardError	0.244	*Total*	168	27.160			
Observations	169						

	Coefficients	*St. Error*	*t Stat*	*P-value*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.292	0.057	5.156	0.000	0.180	0.403
Organisation Structure	0.708	0.042	17.041	0.000	0.626	0.790

Based on the positive value (0.71) of the beta statistic as well as the p-values of the t and F-statistics at a 5% level of significance, the linear regression model confirms H11 that organization structure has a positive and significant effect on cloud computing adoption. The value of R square implies that organization structure can explain 63.5% of the variation in cloud computing adoption.

H12: Privacy risk will have a positive and significant effect on cloud computing adoption.

Regression Statistics		**ANOVA**					
MultipleR	0.473		*df*	*SS*	*MS*	*F*	*Sig.F*
RSquare	0.223	*Regression*	1	6.066	6.066	48.025	0.000
AdjustedRSquare	0.219	*Residual*	167	21.094	0.126		
StandardError	0.355	*Total*	168	27.160			
Observations	169						

	Coefficients	*St. Error*	*t Stat*	*P-value*	*Lower 95.0%*	*Upper 95.0%*

Intercept	0.313	0.131	2.383	0.018	0.054	0.571
Privacy risk	0.844	0.122	6.930	0.000	0.603	1.084

Based on the positive value (0.84) of the beta statistic as well as the p-values of the t and F-statistics at a 5% level of significance, the linear regression model confirms H12 that privacy risk has a positive and significant effect on cloud computing adoption. The value of R square implies that privacy risk can explain 22.3% of the variation in cloud computing adoption.

H13: Government support will have a positive and significant effect on cloud computing adoption.

Regression Statistics		**ANOVA**					
$MultipleR$	0.414		df	SS	MS	F	$Sig.F$
$RSquare$	0.172	$Regression$	1	4.660	4.660	34.586	0.000
$AdjustedRSquare$	0.167	$Residual$	167	22.500	0.135		
$StandardError$	0.367	$Total$	168	27.160			
Observations	169						

	Coefficients	*St. Error*	*t Stat*	*P-value*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.333	0.150	2.219	0.028	0.037	0.630
Government Support	0.833	0.142	5.881	0.000	0.554	1.113

Based on the positive value (0.83) of the beta statistic as well as the p-values of the t and F-statistics at a 5% level of significance, the linear regression model confirms H13 that government support has a positive and significant effect on cloud computing adoption. The value of R square implies that government support can explain 17.2% of the variation in cloud computing adoption.

H14: Regulatory concerns will have a postive and significant effect on cloud computing adoption.

Regression Statistics		**ANOVA**					
$MultipleR$	0.774		df	SS	MS	F	$Sig.F$
$RSquare$	0.599	$Regression$	1	16.280	16.280	249.882	0.000
$AdjustedRSquare$	0.597	$Residual$	167	10.880	0.065		
$StandardError$	0.255	$Total$	168	27.160			
Observations	169						

	Coefficients	*St. Error*	*t Stat*	*P-value*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.320	0.059	5.414	0.000	0.203	0.437
Regulatory Concern	0.680	0.043	15.808	0.000	0.595	0.765

Based on the positive value(0.68) of the beta statistic as well as the p-values of the t and F-statistics at a 5% level of significance, the linear regression model rejects H14 that regulatory concern has a negative and significant effect on cloud computing adoption. The value of R square implies that Regulatory concern can explain approximately 60% of the variation in cloud computing adoption.

H15: External pressures will have a positive and significant effect on cloud computing adoption.

Regression Statistics		**ANOVA**					
$MultipleR$	0.668		df	SS	MS	F	$Sig.F$
$RSquare$	0.446	$Regression$	1	12.111	12.111	134.391	0.000
$AdjustedRSquare$	0.443	$Residual$	167	15.049	0.090		
$StandardError$	0.300	$Total$	168	27.160			
Observations	169						

	Coefficients	*St. Error*	*t Stat*	*P-value*	*Lower 95.0%*	*Upper 95.0%*

Intercept	0.443	0.069	6.379	0.000	0.306	0.580
External pressure	0.557	0.048	11.593	0.000	0.462	0.652

Based on the positive value (0.56) of the beta statistic as well as the p-values of the t and F-statistics at a 5% level of significance, the linear regression model confirms H15 that external pressure has a positive and significant effect on cloud computing adoption. The value of R square implies that External pressure can explain 44.6% of the variation in cloud computing adoption.

H16: Culture will have a negative and significant effect on cloud computing adoption.

Regression Statistics		**ANOVA**					
$MultipleR$	0.599		*df*	SS	MS	F	$Sig.F$
$RSquare$	0.359	$Regression$	1	9.740	9.740	93.382	0.000
$AdjustedRSquare$	0.355	$Residual$	167	17.419	0.104		
$StandardError$	0.323	$Total$	168	27.160			
Observations	169						

	Coefficients	*St. Error*	*t Stat*	*P-value*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.258	0.101	2.562	0.011	0.059	0.457
Culture	0.871	0.090	9.663	0.000	0.693	1.049

Based on the positive value (0.87) of the beta statistic as well as the p-values of the t and F-statistics at a 5% level of significance, the linear regression model rejects H16 that culture has a negative and significant effect on cloud computing adoption. The value of R square implies that culture can explain approximately 35.9% of the variation in cloud computing adoption.

H17: Industry type will have a positive and significant effect on cloud computing adoption.

Regression Statistics		**ANOVA**					
$MultipleR$	0.944		*df*	SS	MS	F	$Sig.F$
$RSquare$	0.892	$Regression$	1	24.225	24.225	1378.491	0.000
$AdjustedRSquare$	0.891	$Residual$	167	2.935	0.018		
$StandardError$	0.133	$Total$	168	27.160			
Observations	169						

	Coefficients	*St. Error*	*t Stat*	*P-value*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.043	0.033	1.325	0.187	-0.021	0.108
Industry Type	0.978	0.026	37.128	0.000	0.926	1.030

Based on the positive value (0.98) of the beta statistic as well as the p-values of the t and F-statistics at a 5% level of significance, the linear regression model confirms H17 that industry type has a positive and significant effect on cloud computing adoption. The value of R square implies that industry type can explain 89.2% of the variation in cloud computing adoption.

H18: Direct benefits will have a positive and significant effect on cloud computing adoption.

Regression Statistics		**ANOVA**					
$MultipleR$	0.797		*df*	SS	MS	F	$Sig.F$
$RSquare$	0.635	$Regression$	1	17.243	17.243	290.380	0.000
$AdjustedRSquare$	0.633	$Residual$	167	9.917	0.059		
$StandardError$	0.244	$Total$	168	27.160			
Observations	169						

	Coefficients	*St. Error*	*t Stat*	*P-value*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.292	0.057	5.156	0.000	0.180	0.403

Direct Benefits	0.708	0.042	17.041	0.000	0.626	0.790

Based on the positive value (0.71) of the beta statistic as well as the p-values of the t and F-statistics at a 5% level of significance, the linear regression model confirms H18 that direct benefits have a positive and significant effect on cloud computing adoption. The value of R square implies that direct benefits can explain 63.5% of the variation in cloud computing adoption.

H19: Indirect benefits will have a positive and significant effect on cloud computing adoption.

Regression Statistics		**ANOVA**					
$MultipleR$	0.963		*df*	SS	MS	F	$Sig.F$
$RSquare$	0.927	$Regression$	1	25.189	25.189	2134.438	0.000
$AdjustedRSquare$	0.927	$Residual$	167	1.971	0.012		
$StandardError$	0.109	$Total$	168	27.160			
Observations	169						

	Coefficients	*St. Error*	*t Stat*	*P-value*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.029	0.027	1.093	0.276	−0.024	0.082
Indirect Benefits	0.985	0.021	46.200	0.000	0.943	1.028

Based on the positive value (0.99) of the beta statistic as well as the p-values of the t and F-statistics at a 5% level of significance, the linear regression model confirms H19 that indirect benefits have a positive and significant effect on cloud computing adoption. The value of R square implies that indirect benefits can explain 92.2% of the variation in cloud computing adoption. The regression models confirm the relationships observed in the Pearson correlation matrix.

4. SUMMARY AND CONCLUSIONS

In this study, the adoption of cloud computing in the Saudi government sector was studied and the results facilitate an understanding of the movement to cloud computing technologies. The study reveals that 85.80% of the respondents in the targeted organisations supported the adoption of cloud computing technology while 97.63% of the respondents perceived usefulness as the most important factor in adopting cloud computing and 95.26% of the respondents also perceived service quality and security as the most important factors in the adoption of cloud computing. The responses to the cloud computing adoption survey show that 96.7% of the respondents perceived service quality and security concern are the most important factor in adopting Cloud computing.

Inferential analyses show that the respondents who consider service quality to be an important factor in the adoption of cloud computing have a statistically significantly lower adoption attitude. The respondents who consider the cost of cloud computing technology as an important factor also have a statistically significant lower adoption attitude when compared to respondents who do not consider cost as important. Similarly, respondents who consider the size of the organisation feasibility direct benefits and indirect benefits as important in the adoption of cloud computing have a statistically significantly lower adoption attitude.

Testing the research hypotheses using T-test analysis reveals that service quality, usefulness, security concerns, cost, size of organisation, IT infrastructure readiness, feasibility, trust, structure of organisation, Privacy risk, government support, external pressures, industry type, direct benefits and indirect benefits all have a positive and significant effect on cloud computing adoption. In addition, the regression analysis supports these findings and also reveals that the cloud computing, is mostly affected by indirect benefits (98.5%), industry type (97.8%), cost (96.4%), trust (96%), and feasibility (91.8%). In contrast, the least influential factors are organisation size (43%), external pressure (55.7%), and regulatory (68%).

These results significantly enhance existing knowledge of the adoption of cloud computing by the Saudi government. This study represents a unique empirical study of government, and the results provide a guide to government organizations in making decisions about adopting the cloud computing, which are encouraged to take these factors into consideration in the process of adopting cloud computing. This study has contributed to existing knowledge by proposing a novel model of the adoption of cloud technology by government. This model was tested and verified, and in addition the study revealed new findings and conclusions.

5. FUTURE WORKS

For better understanding of this issue, a qualitative study will be conducted to enrich the findings. The outcomes of that study will be integrated with the results reported here.

REFERENCES

[1] L. M. Vaquero, L. Rodero-Merino, J. Caceres, and M. Lindner, "A break in the clouds: towards a cloud definition," *SIGCOMM Comput. Commun. Rev.*, vol. 39, pp. 50–55, 2008. [Online]. Available: http://dl.acm.org/citation.cfm?doid=1496091.1496100

[2] R. Buyya, C. S. Yeo, S. Venugopal, J. Broberg, and I. Brandic, "Cloud computing and emerging it platforms: Vision, hype, and reality for delivering computing as the 5th utility," *Future Generation Computer Systems*, vol. 25, pp. 599–616, 2009.

[3] C. G. Cegielski, "Adoption of cloud computing technologies in supply chains: An organizational information processing theory approach," *International Journal of Logistics Management*, vol. 23, pp. 184–211, 2012. [Online]. Available: http://www.emeraldinsight.com/journals.htm?articleid=17051079

[4] M. Castells, "The internet galaxy: Reflections on the internet, business, and society," 2001.

[5] M. Peter and G. Tim, *The NIST Definition of Cloud Computing*. New York: Association for Computing Machinery, 2010, vol. 53, p. 50.

[6] H. Brian, "Cloud computing," *Association for Computing Machinery. Communications of the ACM*, vol. 51, p. 9, 2008.

[7] Hofmann, "Erp is dead, long live erp," *IEEE Internet Computing*, vol. 12, pp. 84–88, 2008. [Online]. Available: http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=4557984

[8] A. D. McDonald MP, "The business perspective of cloud computing : Actors , roles , and value networks," *An-Institut und wissenschaftliche Einrichtung der Technischen*, 2013. [Online]. Available: http://www.gartner.com/id=2310018

[9] E. Anderson, L. Lam, Y. Dharmasthira, S. Cournoyer, C. Tornbohm, and J. Roster, "Forecast: public cloud services, worldwide," *Gartner*, 2013. [Online]. Available: http://www.gartner.com/id=2391015

[10] P. Mell and T. Grance, "The nist definition of cloud computing recommendations of the national institute of standards and technology special publication," *The National Institute of Standards and Technology (NIST)*, pp. 800–145, 2011. [Online]. Available: http://csrc.nist.gov/publications

[11] M. Armbrust, A. Fox, R. Griffith, A. D. Joseph, R. H. Katz, A. Konwinski, G. Lee, D. A. Patterson, A. Rabkin, I. Stoica, and M. Zaharia, "Above the s: A berkeley view of cloud computing." EECS Department, University of California, Berkeley, Conference Proceedings.

[12] R. Bose and X. Luo, "Integrative framework for assessing firms' potential to undertake green it initiatives via virtualization–a theoretical perspective," *The Journal of Strategic Information Systems*, vol. 20, no. 1, pp. 38–54, 2011.

[13] B. Glick, "Digital britain commits government to cloud computing," 2009. [Online]. Available: http://computing.co.uk/computing/news/2244229/digit

[14] j. . D. y. . . t. . J. Government of the United Kingdom, title = Digital Britain The final report.

[15] V. Kundra, "Cloud computing: Benefits and risks of moving federal it into the cloud," Report, 2010. [Online]. Available: http://oversight.house.gov

[16] R. Mark, "Do federal agencies belong in cloud computing networks?" *eWeek*, 2008. [Online]. Available: http://www.eweek.com/c/a/Government-IT/Should-Feds-Climb-on-the-Cloud/

[17] B. Obama, "Cloud computing," 2009. [Online]. Available: http://www.whitehouse.gov

[18] R. Hicks, "Thailand hatches plan for private cloud," 2009. [Online]. Available: http://www.futuregov.net/articles/2009/may/25/thailand-plans-private-cloud-e-gov/

[19] K. Ng, "Japan gov't plots private cloud," *FutureGov*, 2009. [Online]. Available: futuregov.net/articles/2009/may/18/japan-govt-plots-private-cloud/

[20] M. o. I. A. MIC, Government of Japan and Communications, "Mic announces the outline of digital japan creation project (ict hatoyama plan)," 2009.

[21] D. Rosenberg, "Supercloud looms for japanese government," *CNet*, 2009. [Online]. Available: http://news.cnet.com

[22] J. N. Hoover, "Japan hopes it invest- ment, private cloud will spur economic recovery," *InformationWeek*, 2009. [Online]. Available: informationweek.com/shared/printable Article.jhtml?articleID=217500403

[23] IBM, "Seeding the clouds: Key infrastructure elements for cloud computing," 2009. [Online]. Available: ftp://ftp.software.ibm.com/common/ssi/sa/wh/n/oiw03022usen/OIW03022USEN.PDF

[24] T. Strecker, "Govt it procurement in for shake-up," 2009. [Online]. Available: http://www.stuff.co.nz/technology

[25] D. Nystedt, "Ibm expands presence in vietnam," *PC World*, 2009. [Online]. Available: http://www.pcworld.com
[26] C. Babcock, "Ibm talks up cloud com- puting: "cloud computing is a new way of consum- ing it."," *InformationWeek*, 2009. [Online]. Available: informationweek.com/news/software/hosted/showArticle.jhtml?articleID=218101617
[27] Research and M. A. Report, "Saudi arabia information technology report q4," Report, 2010. [Online]. Available: http://www.highbeam.com/doc/1G1-243578676.html
[28] I. S. A. Cloud, "Cloud computing in saudi arabia moves from 'hype' to 'test' phase," 2014.
[29] K. Zhu, K. L. Kraemer, and J. Dedrick, "Information technology payoff in e-business environments: an international perspective on value creation of e-business in the financial services industry," *Journal of Management Information Systems*, vol. 21, no. 1, pp. 17–54, 2004.
[30] K. Zhu and K. L. Kraemer, "Post-adoption variations in usage and value of e-business by organizations: Cross-country evidence from the retail industry," *Information Systems Research*, vol. 16, pp. 61–84, 2005.
[31] P. Y. Chau and K. Y. Tam, "Factors affecting the adoption of open systems: an exploratory study," *Mis Quarterly*, pp. 1–24, 1997.
[32] A. N. Mishra, P. Konana, and A. Barua, "Antecedents and consequences of internet use in procurement: an empirical investigation of us manufacturing firms," *Information Systems Research*, vol. 18, no. 1, pp. 103–120, 2007.
[33] T. Oliveira, M. F. Martins, and U. N. D. Lisboa, "Literature review of information technology adoption models at firm level," *The Electronic Journal of Information Systems Evaluation*, vol. 14, pp. 110–121, 2011.