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Cloud Computing Critical Factors and Investment Decision: An Empirical Investigation on Jordan Public Sector

Firas M. Alkhaldi
Department of MIS, Faculty of Business, Amman Arab University, Amman, Jordan

Malek M. Qararah
Jordan Public Sector, Tafila, Jordan

Abstract
This article investigate of the most fundamental new trendy concepts in information technology and businesses as well, and attempt to practically identify the major value factors that could affect the investment decisions in technology services and infrastructures. It explore and examine the relationship between the Cloud Computing key characteristics as a key criteria of the investment-decision on Cloud computing technology field where the case study is Jordan public sector (JPS). Making an investment decision on Cloud Computing seems to be affected by the main and most features of Cloud Computing. Cloud Computing (CC) characteristics composed of many advantages that are including decreasing the cost, ability to be expanded, security and ability to manage our business whatever the place or the time. This article presented a practical opportunity to understand the conditions of Cloud Computing characteristics using confirmatory factor analysis. It hypothesized a direct positive relationship between Cloud Computing main factors and investment decision in Cloud Computing refers to as "CCID". Items representing the Cloud Computing key characteristics were developed from the findings of a wide review of previous related studies that are mentioned for the most common features. The main findings suggested that Cloud Computing key characteristics (mostly security and scalability) would encourage and drive Technical Information Departments (TIDs) leaders in Jordan public sector to adopt such technology in their business.
Keywords: Cloud Computing key factors, Investment decision, Jordan public sector

1. Introduction

The scientific and technological innovation, which has expanded and thrived during passed decades and is still advancing rapidly, making the world as a small village, which enabled and enhanced the value of communication, knowledge and experiences exchange among nations and/or individuals, in addition to supporting trade growth and leading to news emergent markets and generating many choices for consumers (OCED, 1998). In the same time, there was an increase of what we know; the contemporary management sciences, that in campuses people management, groups, time and objectives, has helped and supported governments and enterprises to manage their business so as to be successful. In this context, governments, enterprises and people are searching for innovative novel concepts and opportunities that can be employed outside the traditional "black box" of management practices and some times in the domain of services delivered to customers or citizens, and these new forward moving concepts is cloud computing. Where it is refers to a range of computing assets such as infrastructure, platform and software that are available on the network on demand, it is a software applications, data storage, processing capacity or access the internet and they could be offered to individual users or firms (Tsagklis, 2013).

2. Cloud Computing

Cloud Computing (CC) as indicated by Qusay (2011) as an approach by which we can access to a public and joined group of configurable and settable computing resources in a clear and on-demand way. Also, Cloud Computing considered as one of the most important technologies initiatives in business computing today (Hurwitz et. al., 2010). They indicated that this technology is changing the way that business gain access to sophisticated services over the internet and accordingly changing the speed and agility of business without increasing capital expenditure. We can consume a service over the internet, at multiple area, to store our data and use its applications without necessity to keep this information on our private computers and hard drive or upgrading applications for our needs inside our organization. Amin et. al., 2015 argued that, the idea of CC is concentrated around a fundamental idea of maximize usability of IT abilities, where CC, or simply just "the cloud", also focuses on exploiting the effectiveness of the common resources. It can support, not only sharing the resources through a lot of end-users, but also animatedly rearrange and swung these resources according to their requests. As an example, a CC competence that could be used to aid managers throughout their professional worktime with a precise application may swing the same CC assets to assist other employees during their worktime with a different use. This way of handling and dealing these resources and approach will enhance and support increasing usage of computing capabilities and at the same time reducing the global cost of resources by

using a smaller amount of power, air conditioning, rack space, etc. to sustain the system.

2.1 Cloud Computing Key Characteristics

CC key characteristics are the main features and advantages of CC for organizations and people who are using this technology. Researchers such as (Tsagklis, 2013; Bills, 2012; Dufficy, 2015; Rao and Selvamani 2015; Jones 2015) and many more have attempted to point out the most "Key-Characteristics" of CC (see table 1), and it would be summarized as shown below:

- *Agility:* which is the capacity of an organization to adjust speedily to the discrepancies in the business environment and at the same time saving cost in response. It means quicker time to market, employing new people, greater facility to spin up new programs, more usefulness, and generate new goods. All that would be executing in the right way.
- *Cost reduction:* Cost reduction in cloud computing is a result of distributed and shared the cost among all departments and ministries that all of them use and in need for all those resources. Organization have the power and ability to move themselves from capital expansion to operational expansion and this is as a result of purchasing servers and employing new employees.
- *Independency:* which is the ability to access the system without depending on specific time, place or device type. CC application can be accessed by many electronic tools, as traditional PCs, smart phones, tablets etc, that are internet connected (Tsagklis, 2013).
- *Reliability:* CC provide a continuous availability of resources, which means service uptime is in mostly assured. The different cloud service suppliers usually use multiple servers for extreme idleness. When system failure, substitute instances are automatically deposited on additional equipment, and the process of backing up and recuperating data is possible as all data are stored on the cloud and not on a physical means. The different cloud service vendors offer a reliable and elastic backup/recovery resolutions. Also, the cloud itself can be utlilized exclusively as a backup source of the data stored in local PCs (Tsagklis, 2013). It can be summarized as: Ability to maximize availability of the service to end-users, Maximize service performance, Minimize the impact of any failure on customers and Maximize business continuity (Bills, 2012)
- *Scalability:* which is the ability of the application to monitor changes in the demand for resources, like bandwidth, connections, compute, RAM and storage, in real-time. It can then autonomously add or remove resources to the system to cope with that changing demand, all without human intervention, so it makes it simpler for enterprises to extent their service based on consumers demand (Dufficy, 2015).
- *Security:* security in cloud computing is to keep and ensure that your data and information are under the direct and complete your control and managed by professional people who are able to prevent any unauthorized access by anyone else without your permission. (Rao and Selvamani 2015).
- *Loose coupling*: as the technical fundament of cloud computing and through virtualization or other technologies, the frame structure are divided in logic or physic. The consumers or cloud users connect freely with servers or cloud providers.
- *Backup and recovery data*: Since all data are stored in the cloud, backing it up and restoring the same is rather easier as a process comparing with physical its process operation. Additionally, cloud service providers are capable to handle the process of data recovery, and this makes the whole course of backing up and recovery easier than the standard procedures of data storage.
- *Quick Deployment*: can be seen as a very important feature, where CC gives the benefit of fast operation, once moving to this technique of performance, the whole system can be fully functional in a matter of a few minutes.

2.2 Cloud Computing Key Characteristics Attributes

In order to evaluate the most important characteristics of cloud computing, researcher look and review many previous studies related to this field and checked: what was the most important characteristics that mentioned in those studies. In order to be considered the most important one who are actually representing the cloud computing key characteristics. Accordingly, the table (1) below show the results; where this study utilized the most five characteristics:

Table 1. Cloud computing key characteristics mostly reported by related studies

	Cost Saving	Security	Reliability	Scalability	Independency	Virtualization	Agility	Unlimited storage
Amin et. Al., 2015	×	×	×	×	×	×		
Jones 2015	×	×	×	×	×		×	
Davidovica et. al., 2014	×	×		×				×
Hurwitz et. al,. , 2010	×	×		×			×	
Botta et. al,. , 2015		×	×	×				
Gong et. al., 2010		×				×		
Tsagklis, 2013	×		×	×	×			
Ross, 2010	×	×	×					
Apostu et.al, 2014	×			×				×

3. Research Model

Based on the above discussion conceptual model was developed, to investigate the possible relation between the CC key characteristics and the investment decision in cloud computing. Proposed research model is shown below in figure (1). It is hypothesized that all factors must have a direct positive impact on the Investment decision in cloud computing.

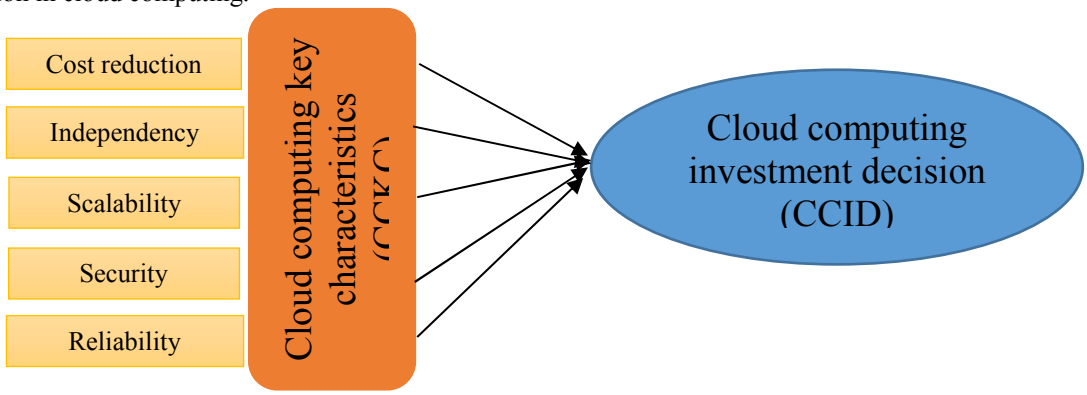

Figure 1. Proposed Model of CCID

To accomplish the objectives of this study, a quantitative approach was handled. Attributes demonstrating the Cloud computing key characteristics were developed from a wide review of literature as explained in pervious sections. The attributes of the scale was measured on a five-point Likert scale from "strongly disagree" to "strongly agree". To establish the content validity the questionnaire was delivered to four experts to evaluate all its items before distribution to the respondents'.

4. Research Methods

4.1 Survey and Procedure

Data were collected from 17 departments and government organizations and questionnaires were circulated to a 92 respondents. Out of the 92, 74 completed questionnaires (88%) were collected and examined for the analysis. To establish the internal consistency, the scales were tested using Cronbach's alpha and the results indicated a score of 0.71 which is considered acceptable. As for normality, standard deviation, skewness and kurtosis indicators were used, and the results confirmed that all variables in this study were normally distributed. KOM measure of sampling adequacy test results equal to 0.676, which indicated that there is an adequate inter item correlations within the data for the use of factor analysis.

4.2 Normality

Normality test is used to measure overall distributions of the examined data and coincided with the normal distribution, Standard Deviation, kurtosis, and skewness, are considered when evaluation of data normality. Where Standard Deviation must not exceed three SD values, for Skewness is a measure of symmetry and Kurtosis is used to test is the "tailedness" of the distribution against the normal bell shape. The results shown in the table 2, confirmed that the study sample is consistent with the normality requirements.

Table 2. Sample results of the normality test

VARIABLE	MCR	MIND	MSPR	MPER	MSEC
MEAN	1.8378	1.8176	2.2027	2.1014	2.1149
STANDARD DEV.	0.5418	0.5384	0.8637	0.5488	0.5367

4.3 Sample Characteristics

The respondents' age was ranging mostly ranging from 30 to 50 years which represented 88% of sample. For the respondent's level of education; the most frequent number of level of education is Bachelor's degree with 69% and the next frequent number is postgraduate degree with 22%. For gender 72% of sample was male. For the respondent's years of experiences; the most frequent number is less than 10 years with 39% and the next frequent number is between 11 and 15 years with 34%. And for their job level; manger and middle management represented 54% of the sample.

5. Data Analysis

5.1 Explanatory factory analysis

The proposed model was analyzed using explanatory factor analysis using SPSS. The results show a two factor dimension rather than one dimension n as proposed. The two new dimensions was labeled as Internal organization climate (IOC), where the results shows that three factors (Independency (MIND), Security (MSEC), and a modified new dimension labeled Service Provider Reliability (MSPER) all forming a new major Factor labeled IOC. The second new dimension named Result Oriented Capabilities (ROC) consist of three new factors (cost reduction (MCR) Performance Reliability (MPER) and finally Scalability (MSCA). Results of the factor analysis process are in table 3

Table 3. Explanatory factor analysis results

Dimensions	Factors	KMO*	Loading Range	TVE**	Cronbach's Alpha
IOC	MIND	0.69	0.86 – 0.76	64.4	0.80
	MSEC	0.57	0.80 – 0.51	49.3	0.64
	MSPER	0.55	0.95 – 0.94	80.0	0.72
ROC	MCR	0.73	0.81 – 0.61	55.2	0.66
	MPER	0.55	0.88 – 0.67	80.0	0.72
	MSCA	0.69	0.84 – 0.58	53.6	0.78

** Kaiser-Meyer-Olkin Measure of Sampling Adequacy. **Total variance explained*

5.2 Confirmatory Factor Analysis

The researchers using EQS 6.3 and utilized various statistical indices to confirm the fitness of the examined data. Hair, et. al., (2009) recommend many indices such as Chi-square, Goodness-of-fit Index GFI), Root Mean Square, and many others, as shown in table 4. All indices confirm a fit model, therefore, the model was accepted and adopted for hypothesis testing of this study.

Table 4. Fit Indices analysis and benchmarks

Fit Indices	Accepted level	Value
Chi-Square	-	**4.235**
Probability Value For The Chi-Square Statistic	≥ 0.05	**0.237**
Bentler-Bonett Normed Fit Index (NFI)	≥ 0.90	**0.961**
Comparative fit Index (CFI)	≥ 0.90	**0.987**
Joreskog-Sorbom's GFI Fit Index	≥ 0.90	**0.981**
Root Mean-Square Error Of Approximation (RMSEA)	≥ 0.50	**0.075**
Cronbach's Alpha	≥ 0.50	**0.739**

5.3 Model Testing

Based on factor analysis model; the variables of this model are nine constructs which are products of the summated scale. There are two dimensions of correlation, where three variables forming a new items "Internal organization climate (IOC)", the last three items forming a new item 'Result oriented capabilities (ROC)". Fit indices as shown in the table 2, where Chi-Square is equal to 4.235 based on 3 degree of freedom and the probability value for the chi-Square statistics is 0.23716 which indicate a fit model and the model has been accepted for further analysis and hypotheses testing. According to the Final model, internal organization climate (IOC)", explained more than 92% of variation in the investment-decision, while Result oriented capabilities (ROC) explained more than 87% of variation in the investment-decision.

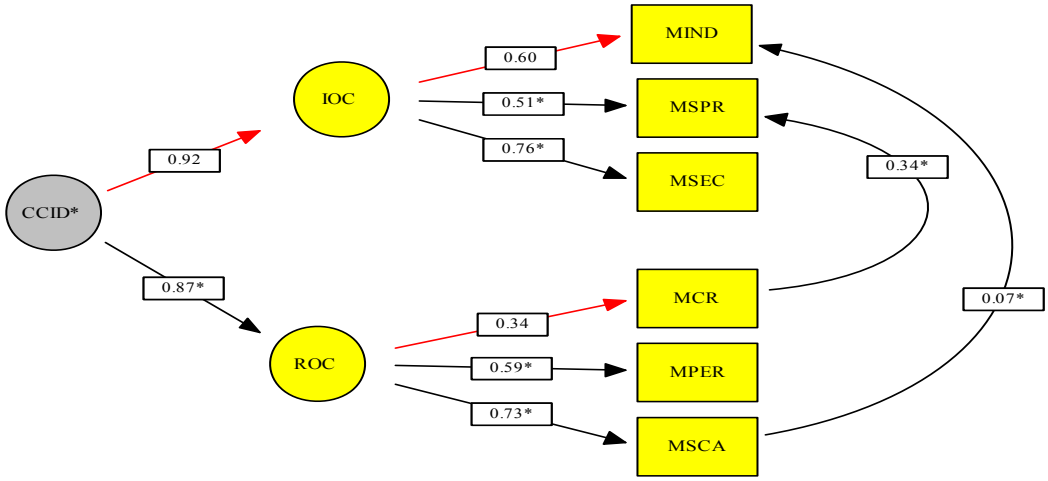

Figure 2: Structural Model results of CCID

5.4 Hypothesis Testing

There is a positive relationship (beta = 0.924) was found between "Internal Organization Climate' and investment decision in Cloud Computing on Jordan Public Sector, where calculated t-value is significant on 0.05 significant level, (R^2 = 0.854). Which indicates that Internal Organization Climate explain 92% of the variance in Investment Decision in Cloud Computing on Jordan Public Sector table 3. and a positive relationship (beta = 0.874) was found between Result Oriented Capability and Investment Decision in Cloud Computing on Jordan public sector, where calculated t-value is significant on 0.05 significant level, (R^2 = 0.764). Which indicates that Result Oriented Capability explain 87% of the variance in Investment Decision in Cloud Computing on Jordan Public Sector.

Table 5. Statistical results of CCID measurement model

Hypothesis	Dimension	Beta (β)	R^2	Result
H1	**IOC**	**0.924***	**0.854**	**Accepted**
H1.1	MIND	0.60*	0.366	Accepted
H1.2	MSPR	0.51*	0.456	Accepted
H1.3	MSEC	0.76*	0.576	Accepted
H2	**ROC**	**0.874***	**0.764**	**Accepted**
H2.1	MCR	0.34*	0.113	Accepted
H2.2	MPER	0.59*	0.351	Accepted
H2.3	MSCA	0.73*	0.534	Accepted

** all Beta (β) are accepted at 0.05 significate level*

6. Discussion and Conclusion

The results indicate that there is a significant relation between the *cost reduction*, as a key characteristics of cloud computing, and the investment decision in Jordan public sector. This implies that applying cloud computing will results on cost reduction (operation cost, Capital cost, human resources). This finding support the work done by Jones (2015) which presented the high capabilities of cloud computing to optimize costs on organizations. And the results show that there is a significant relation between the reliability, as a key characteristics of cloud computing, and the investment decision in Jordan public sector. This implies that once we applying cloud computing technology we will gain its reliability feature and have professional teams who are responsible to manage and deal with the all type of services needed. This finding validates Bills (2012) argument which mentioned that; cloud computing can maximize performance and service availability to the customer and minimizing fault and service disconnection. And the results indicate that there is a significant relation between the *independency*, as a key characteristics of cloud computing, and the investment decision in Jordan public sector. This implies that applying cloud computing will support and offer an independency for end users and organizations where they will be no more dependent on location, time, or type of accessing device to deal and handle their work. This finding confirms Tsagklis, (2013) argument that by adopting cloud Computing you can managed and access work using various capable devices that are able to have access to the internet and Bring your own device" (BYOD) policy can be simply embraced, which allows staffs to use their own mobile tools to the workplace, as there are no restraint on locations and means but they can do the work anywhere around the world. And the results show that there is a significant relation between the *security*, as a key characteristics of cloud computing, and the investment decision in Jordan public sector. This implies that applying cloud

computing will bring and support good enough security for end users and organizations regarding their data and information. This findings coincided with (Ross, 2010) who claimed that perceived security effectiveness of cloud computing consider as a driver factor for decision making managers to adopt this technology. And the results show that there is a significant relation between the scalability, as a key characteristics of cloud computing, and the investment decision on Jordan public sector. This implies that applying cloud computing will support and offer a high range of scalability and elasticity for end users and organizations. This finding also validates the work of (Fardone, 2012; Dufficy, 2015). As for future directions to this study, the researchers suggest to expand the study to include the private sector and include a more decision-lead factors.

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