



# Adoption of Cloud Computing: A Key Performance Analytics for Technological Firms

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**Abstract:** Cloud computing provides a stable and highly customizable infrastructure to the firms which can enable them to expand their businesses while adding more value and efficiency to the operations. The primary aim of this research is to investigate if the adoption of cloud computing has a positive impact on performance of the firm. The adoption of cloud computing is discussed with the context of its three factors: Human (Personal innovativeness, IT/IS competence, High Performance computing), Organization (Top management support, Organization cultures), and Environment (Server location and Regulatory Support) to understand its influence on the performance of firm. For this purpose, the study has devised a survey questionnaire, for which the data has been collected from 200 individuals working in the information technology industry of Pakistan. The results are analyzed using statistical tools SMART PLS. The findings of this research indicates that top management support, regulatory support, personal innovativeness and IT/IS competence has a positive impact on the adoption of cloud computing. However, no significant relationship was found between three variables (HPC competence, Organization Cultures and Server Location) on the adoption of cloud computing. However, the study concludes that adoption of cloud computing has a positive impact on the performance of the firm.

**Keywords:** Cloud Computing, Performance Analytics, IT Competence, High Performance Computing, Server Location, Regulatory Support

## 1. INTRODUCTION

Cloud computing is regarded as one of the most recent emerging concepts that have revolutionized the world of Information Technology. Adoption of cloud computing in businesses tend to have significant amount of impact on the performance of the firms, given the information and resources are being used efficiently[1]. It has also been noted the impact of cloud computing on the businesses tend to vary in regards with the strategies being used in the firm[2]. Furthermore, the underlying concerns and issues must be addressed before integrating the technology of cloud computing to avoid negative experience.

As an attempt to understand the implication of cloud computing on firm performance, this study aims to explore three areas of a business or an organization that

may directly experience the shift from traditional infrastructure to cloud computing. These three areas are: Human, Organizational, and Environmental. Personal innovativeness, IT/IS competence, High Performance computing are the human aspects of integrating cloud computing that may impact the firm performance and hence, is required to be investigated. Moreover, the influence of Top management support and Organization cultures on firm performance after the adoption of cloud computing is also investigated. Lastly, this research also investigates the relationship of Server location and Regulatory Support with firm performance as a consequence of adaption of cloud computing.

Despite numerous studies indicating on the effectiveness of cloud computing on the performance of firms, it has been found that the acceptance and integration of cloud related technology is still scarce [3].



The popularity of cloud computing services has found to be increasing in the first world countries and developed nations, however, its implementation in developing nation is critically low [4]. The small and medium enterprises tend to perceive cloud computing as a feature that may require extensive capital which may possibly hinder the overall performance of the firm [5]. This indicates a gap in literature that the implication of effectiveness associated with cloud computing on firm performance is similar, whether the firm is small or large in size.

Even though it has been noted that many industries, such as government, science and technology, and health have started to accommodate cloud computing to certain extent in their operations, the application of these services remain unused in large part of the world. The lack of confidence in cloud computing services and its influence on the firm performance is vaguely discussed in the context of undeveloped countries like Pakistan. This study aims to analyze the impact of adoption of cloud computing on the performance of the firm to conclude if the impact of former on latter is positive

The primary aim of this research is to investigate if the adoption of cloud computing has a positive impact on performance of the firm. The adoption of cloud computing is discussed with the context of its three factors: Human (Personal innovativeness, IT/IS competence, High Performance computing), Organizational (Top management support, Organization cultures), and Environmental (Server location and Regulatory Support) to understand its influence on the performance of firm.

The secondary objectives of this research are to:

- To investigate the impact of personal innovativeness on firm performance after the adoption of cloud computing.
- To analyze the impact of IT/IS competence on firm performance after the adoption of cloud computing
- To study the impact of High-Performance computing competence on firm performance after the adoption of cloud computing
- To assess the impact of top management support on firm performance after the adoption of cloud computing
- To evaluate the impact of organization culture on firm performance after the adoption of cloud computing
- To analyze the impact of server regulation on firm performance after the adoption of cloud computing
- To study the impact of regulatory support on firm performance after the adoption of cloud computing
- To evaluate the impact of adoption of cloud computing on the performance of firm.

The scope of this research is limited to the understanding of adoption of cloud computing and its impact on the firm performances in Pakistan. Moreover, this research aims to explore the three dimensions associated with cloud computing, which are human factor, organizational factor and environmental factor to investigate the implication adoption of cloud computing in these areas influence performance of the firms in Pakistan.

## 2. BACKGROUND INFORMATION

In literature of cloud computing, there are various studies that have glorified the existence of cloud computing and regarded it as an essential part of the businesses, especially the firms working in the industry of Information and Technology. Cloud computing is most commonly referred to as cloud, which indicates a platform for shared usability that comprise on a group of interface, software, network, and servers. The collaboration of these networks and servers exist to assist human resource in performing tasks in more efficient way [6].

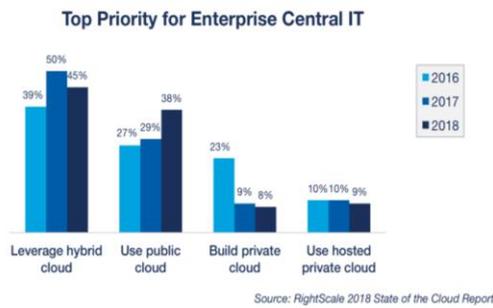
The term computing in the notion of cloud computing refers to the deliverance of services which enables users to interact with it in a manner that is most useful to them [7]. Modern cloud computing offers cost effective and time effective solution to its users with variety of different packages and offers entities can opt for [8]. Some of these packages offer a one-time payment to its users, while others offer pay-per access model that further allows user to explore options based on their necessity or convenience [9]. Among many others, most of the features offered by these cloud computing third parties include networking services, application, storage and servers for ease and accessibility. Cloud computing empowers user to access their desired information across the devices, such as smartphones, laptops, desktop and tablets, using the servers on cloud [10].

Cloud computing offers a platform to its users that ensures a system that consistently adds value to the business. Among many other benefits attached with its integration, flexibility, ease of access, and customization as the prime elements that distinctively improves the overall performance of the firm [11]. The fundamental purpose of adopting cloud computing is to ensure that the operations associated with the firm are technologically supported and being taken care of, while the human resources are occupied with other tasks [12]. Human resource of the company can be allocated for better use and innovativeness, while the mundane tasks of operations can be appointed to the cloud services for efficient process [13].

Cloud computing services are based extensively on the highly adaptive infrastructure within the horizon of information technology that enables multiple users to interact with the servers separately. The dynamic range of services and outputs have also contributed in its popularity among small as well as large businesses all

over the world, as it offers convenience of engaging multiple users at the same time but differently based on their needs [14].

Among many other advantages associated with the adoption of cloud computing, that cloud computing does not only reduces the cost of entry but also serves as a time-effective measure for operations in both, big and small enterprises [15]. The benefits of adopting cloud computing are not only limited to large organizations with ample amount of capital to invest, but it can also be deemed as equally efficient for the small businesses. This is due to the fact that cloud computing offers a dynamic range of services, tailored to the need of business using it [16].



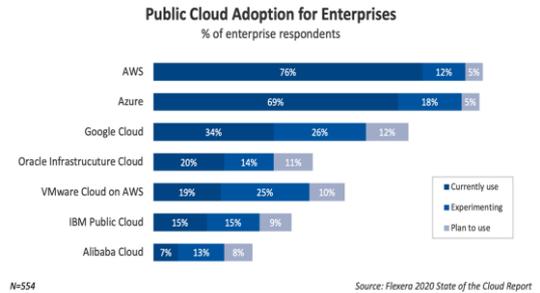
### A. Cloud Computing and Firm Performance

Similarly, the adoption of cloud computing is found to have a positive influence on the performance of the firm as it yields reports and insights that are favorable for the top management to make effective decisions [17]. Moreover, the organizational benefits attached with the cloud computing suggesting that it can have a positive impact on establishing the culture for the firm, which includes maintaining and updating the payroll, attendance, incentives based on objective performance and other related tasks [18].

### B. Environmental Aspect and Cloud Computing

It has been found that the environmental aspect of adoption of cloud computing also has a significant influence on the performance of the firm, as it involves the upgradation of technological skill set among its employees [19]. Not only this, the implementation of technological advancement offers better networking speed, reduced cost of maintenance, and efficiency throughout the process of carrying out tasks [20]. One of the major contributors of change in the environment is the regulatory support. This is due to the fact that cloud computing services require low-grade maintenance, which are mostly secured by the service provider. Since cloud computing services are often provided with regulatory services, therefore, it reduces the pressure of the firm to consistently maintain their servers and networks. All of these factors associated with the

adoption of cloud computing tend to highlight its influence on the performance of the firms [21].



### C. Factors Related to Adoption of Cloud Computing

Based on the context provided above identified in this research, following is the conceptual framework that illustrates the flow of research:

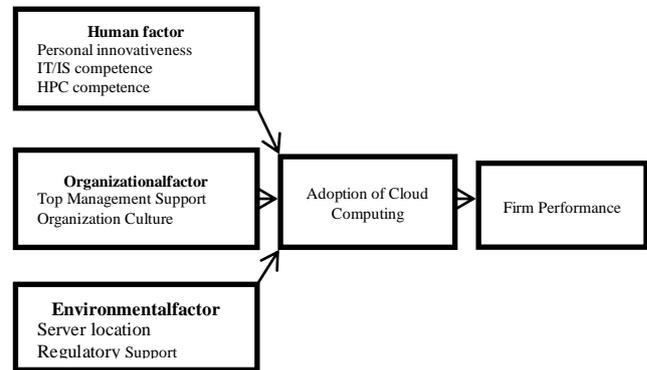


Figure 1: Conceptual Model

In accordance with the conceptual model above, the independent variables of this research are human factor (Personal Innovativeness, IT/IS Competence, HPC Competence), Organizational (Top Management Support, Organization culture), and Environmental (Server Location, Regulatory Support). The dependent variable used in this study is Firm Performance, while the mediator between independent and dependent variable used in this research is Adoption of Cloud Computing.

### 3. DATA GATHERING AND APPROACH

Data collection method is referred to as the method or the way a researcher chooses in order to obtain information that is relevant to the research [22]. This obtained information is then analyzed to produce results that answer the research question. Fundamentally, there are two ways to collect data, secondary and primary; where primary data is considered as the one which has been obtained solely for the purpose of the research and secondary data is one that has been published prior to the



research in some other context .In this study, primary methods of data collection have been opted. The purpose of using primary methods of data collection is to ensure that the information obtained for this study is specific to the Information Technology Industry in Pakistan. Therefore, a survey questionnaire has been developed to gather data that determines the impact of various aspects of cloud computing on performance of the firms in Pakistan.

Research approach refers to the selection of appropriate methods and steps to ensure that the research is relevant and authentic. There are two main forms of research approach, inductive and deductive. While inductive approach require researcher to explore the subject area as an attempt to emerge a new dimension associated with the topic, the purpose of deductive approach is to test and validate the hypotheses based on the context of the research. This study uses deductive approach as the data used in this study requires testing the relationships of independent and dependent variable using the model of hypotheses.

The sample size used for this research is 200 and the sampling technique applied in this research is convenience sampling method. The purpose of using convenience sampling method is to ensure that the data is collected through the most relevant individuals in Pakistan; therefore, only employees working in IT industry of Pakistan were approached.

#### 4. DATA ANALYSIS

This section explained the data analysis process, as SEM analysis was done with the help of SMART PLS software in order to know the relationship between the variables. Because, through PLS-SEM the researcher can easily interpret the cause-effect relationship between latent variable.

##### A. Factor Loading

The values presented in the table indicate the loadings for each item for the construct developed in this study. The values of each of these items are required to be above 0.7 to ensure that the weight of construct is significant enough to carry on with the research. Since values for each of the item mentioned above is above the threshold of 0.7 therefore, it can be concluded that the constructs are valid and can be used in the further analysis of this study

TABLE 1 FACTOR LOADING

	AC	FP	HPC	IT/IS	OC	PI	RS	SL	TM
AC1	0.92								
AC2	0.85								
AC3	0.74								
FP1		0.80							
FP2		0.82							

FP3		0.80							
HPC			0.86						
HPC			0.84						
HPC			0.74						
IT/IS1				0.77					
IT/IS2				0.83					
IT/IS3				0.83					
OC1					0.86				
OC2					0.81				
OC3					0.89				
PI1						0.89			
PI2						0.86			
PI3						0.82			
RS1							0.72		
RS2							0.91		
RS3							0.83		
SL1								0.75	
SL2								0.82	
SL3								0.85	
TM1									0.83
TM2									0.85
TM3									0.78

Where PI = Personal Innovativeness,

IT/IS = IT/IS Competence

HPC= High Performance Competency

The values presented in diagram showing the overloading of each variable as the human factor i.e. (Personal Innovativeness, IT/IS Competence, HPC Competence)

TM=Top Management Support

OC=Organization Culture

Again the construct of each variable in the diagram is above 0.70

As each of the construct is above 0.70. Which shows organizational factor i.e. (Top Management Support, Organization Culture)

SL=Server Location

RS=Regulatory Support

The construct of each factor is also 0.70 to ensure that the construct is significance. Finally Environmental factor i.e (Server Location, Regulatory Support).

APC= Adoption of cloud computing



FP= Firm Performance

Both the construct each item reported the value above 0.70 which showed that constructs are valid.

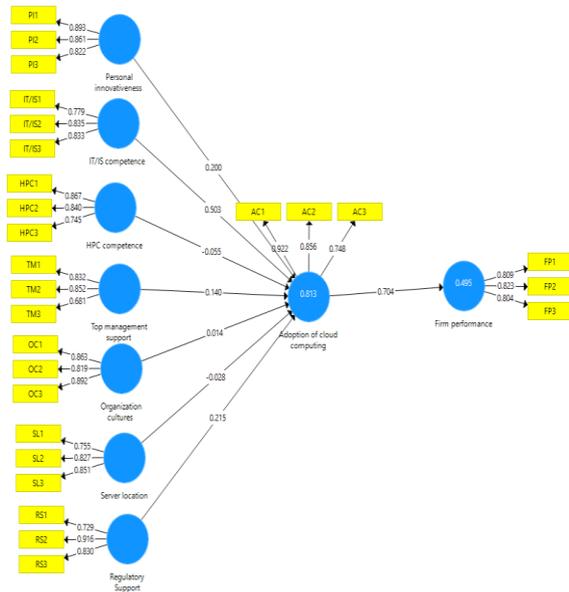


Figure 2: Factor Loading

**B. Reliability**

The reliability of each of the constructs developed for this research is ensured using the values of Mean, Standard Deviation, Composite Reliability and AVE (Average Variance Extracted). It is essential for the value of Composite Reliability to be above 0.6; and AVE to be above 0.6 in order to consider the construct as reliable. Since the criteria for all these measurable variances are complied, therefore, each variable of this research is deemed reliable.

TABLE 2. RELIABILITY

	Mean	S.D	Composite Reliability	Average (AVE)
Adoption of cloud computing	3.56	0.83	0.88	0.71
Firm performance	3.78	0.75	0.85	0.65
HPC competence	3.98	0.79	0.85	0.67
IT/IS competence	4.74	0.75	0.85	0.66
Organization cultures	0.82	0.82	0.89	0.73
Personal innovativeness	0.82	0.82	0.89	0.73
Regulatory Support	0.76	0.78	0.86	0.68
Server location	0.74	0.76	0.85	0.65
Top management support	0.70	0.73	0.83	0.62

**C. Discriminate Validity**

Discriminant validity refers to the uniqueness of the variables and the distinction from one variable the other [23]. A variable is said to be unique and uncorrelated if its value is closer to 1. Based on the table of discriminant validity above, it can be observed that each of the construct or the variable is fairly distinct from one another and therefore, can be deemed as valid for the research.

TABLE 3. DISCRIMINATE VALIDITY

	Adoption of cloud computing	Firm performance	HPC competence	IT/IS competence	Organization cultures	Personal innovativeness	Regulatory Support	Server location	Top management support
Adoption of cloud computing	0.84								
Firm performance	0.70	0.81							
HPC competence	0.58	0.58	0.81						
IT/IS competence	0.85	0.66	0.58	0.81					
Organization cultures	0.75	0.71	0.60	0.78	0.85				
Personal innovativeness	0.79	0.69	0.63	0.73	0.76	0.85			
Regulatory Support	0.76	0.79	0.64	0.69	0.72	0.76	0.82		
Server location	0.65	0.65	0.60	0.66	0.69	0.66	0.69	0.81	
Top management support	0.72	0.54	0.64	0.69	0.66	0.72	0.62	0.66	0.79

**D. Path Coefficient SEM Analysis**

The table of path coefficient is used to determine the strength of the relationship between two variables. It also indicates whether the relationship between two variables is positive or negative [24]. In accordance with the table above, it can be observed that the hypothesis suggesting a positive relationship between adoption of cloud

computing and firm performance is accepted as the value of P is 0.000 (less than 0.05) and value of T is 14.370 (above 0.000). In addition to this, the hypothesis stating a positive relationship between HPC competence and adoption of cloud computing is rejected as the value of P is more than the threshold value of 0.05. On the other hand, the hypothesis suggesting a positive relationship of IT/IS competence with adoption of cloud computing is accepted with the value of P as 0.000 and value of T is 8.688. It is also noted that the hypotheses suggesting the relationship between personal innovativeness and cloud computing, regulatory support and cloud computing and top management support and cloud computing have been accepted. This is because the P-Value of all three hypotheses is below the threshold level of 0.05 and the value of T is above 0.000 which indicates that the relationship between three independent variables and cloud computing is positive. Lastly, it is found that the relationship between server location and adoption of cloud computing has found to be insignificant as the value of P is 0.681.

TABLE 4. PATH COEFFICIENT SEM ANALYSIS

	Beta	Std.Dev	T-Stats	P Values	Results
Adoption of cloud computing -> Firm performance	0.704	0.049	14.37	0.00	Accepted
HPC competence -> Adoption of cloud computing	0.055	0.053	1.025	0.30	Rejected
IT/IS competence -> Adoption of cloud computing	0.503	0.058	8.688	0.00	Accepted
Organization cultures -> Adoption of cloud computing	0.014	0.064	0.218	0.82	Rejected
Personal innovativeness -> Adoption of cloud computing	0.200	0.080	2.486	0.01	Accepted
Regulatory Support -> Adoption of cloud computing	0.215	0.084	2.568	0.01	Accepted
Server location -> Adoption of cloud computing	0.028	0.067	0.412	0.68	Rejected
Top management support -> Adoption of cloud computing	0.140	0.070	1.996	0.04	Accepted

The figure 3 reflects the SEM analysis which portrayed the relationship between each of the variable.

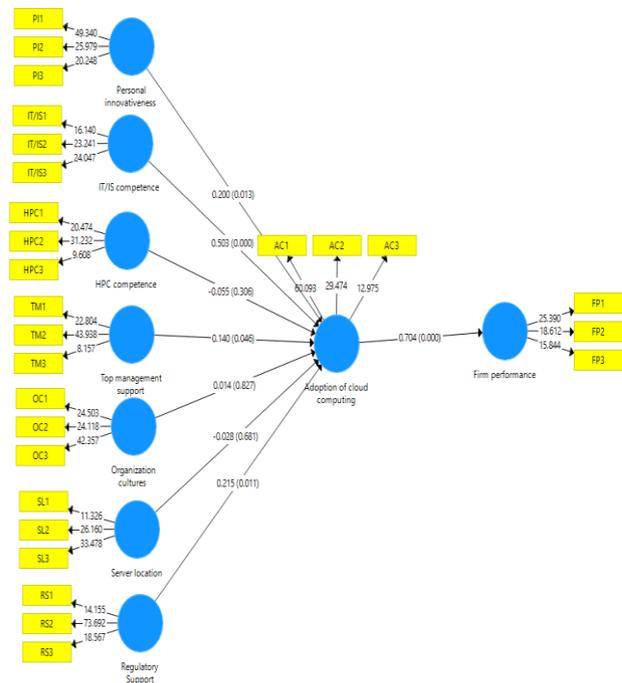


Figure 3: SEM Analysis

## 5. CONCLUSION AND RECOMMENDATION

In the recent times, more and more companies in the developed nations are migrating towards cloud computing, which implies the transformation of their existing services through emerging virtual cloud computing services [25]. The adoption of cloud computing entails that certain tasks are assigned virtually to the applications and networking services to ensure efficiency and cost-effectiveness. The literature on this subject have significantly emphasized on its efficiency, controllability, and flexibility as the part of its service provision. However, it is found that regardless of its undeniable effectiveness in the daily operations of a business, most companies hesitate to integrate these services in their firms. Moreover, its application in the developed nations is comparatively better than in the developing nations like Pakistan. This is due to the fact that many businesses perceive the adoption of cloud computing as expensive venture and do not fully comprehend its impact on the firm's performance.

Therefore, in order to signify the importance of different aspects of cloud computing on firm's performance, this study aims to explore three aspects of cloud computing that may impact performance of the firm. These three factors associated with cloud computing are: Human, Organizational, and Environmental. Personal innovativeness, IT/IS competence, High Performance, Top management support, Organization cultures, Server location and Regulatory Support are the identified

independent variables of this research that relates to the mediating variable of this study: Adoption of Cloud Computing. The influence of these variables is further investigated in regards to the influence these have after the adoption of cloud computing on the performance of firms in Pakistan.

In order to conclude this research, the study has developed a closed ended survey questionnaire, which includes the data that has been collected from 200 individuals working in the Information and Technology industry of Pakistan. The data obtained from the survey was then analyzed to ensure that the constructs are valid and reliable. The statistical tools have been used to analyze results of this research.

The findings of this research indicates that top management support, regulatory support, personal innovativeness and IT/IS competence has a positive impact on the adoption of cloud computing. However, no significant relationship was found between three variables (HPC competence, Organization Cultures and Server Location) on the adoption of cloud computing. Moreover, the study concludes that adoption of cloud computing has a positive impact on the performance of the firm.

This research recommends business owners, policy makers, and decision makers to integrate the features of cloud computing in their businesses as the positive impact of adopting cloud computing is evident through this research, which can translate in improvising business performance.

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