Adoption of Infrastructure as a Service (IaaS) in Organizations in Bengaluru, India: A Study with Respect to Organizational Factors for Mobile Device Management Software Products

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Abstract: Software products comprises of web applications, desktop applications, mobile applications, banking applications, etc. They are available in various formats like ISOs, CDs, DVDs, appliances catering to the needs of markets like IT, ITES, Banking, Finance, Insurance, Medical, Pharmaceutical etc. The recent emergence of various technological platforms in the field of Cloud Computing services like, Infrastructure-as-a-service, Platform-as-a-service, Software-as-a-service has influenced the software industry to a large extent in the areas like business, technology and end-user experience of the product.

While each of the CLOUD COMPUTING service model has advantages one over the other, but it posed several challenges to the buying decisions of the customers. The goal of this research paper is to assess the effect of factors in terms of organizational context namely organizational readiness, organizational size and top management support, on the buying behaviour of customers for adoption of cloud computing deployment model Infrastructure As A Service (IaaS).

Keywords: Organizational Factors, Adoption, Infrastructure-as-a-Service(IaaS), Mobile device management, Software product

1. INTRODUCTION

Rouse M (2017) has defined IaaS (Infrastructure-as-a-service) is a type of cloud computing service model that provides virtualization of computing resources like servers, storage and networking hardware over the public network such as internet. Infrastructure-as-a-service is one of the three main types of cloud deployment services, along with SaaS (software-as-a-service) and PaaS(platform-as-a-service).

In an IaaS cloud service model, the cloud service provider hosts the IaaS components which comprises of servers, networking hardware and storage, and virtualization layer on which customer can deploy their application services.

IaaS customers will access these services and resources through a public network such as the internet, and can install the remaining components of an application stack over IaaS resources and services. To further discuss, the user logs in to the IaaS platform to create VMs(virtual machines); install operating systems(windows, linux) in each VM; and then installs middleware applications, such as Office applications, databases, create backups, into those VMs. Customers can also use the vendor's services to troubleshoot application problems, monitor performance, track cost, balance the load of network traffic, disaster recovery management and more.
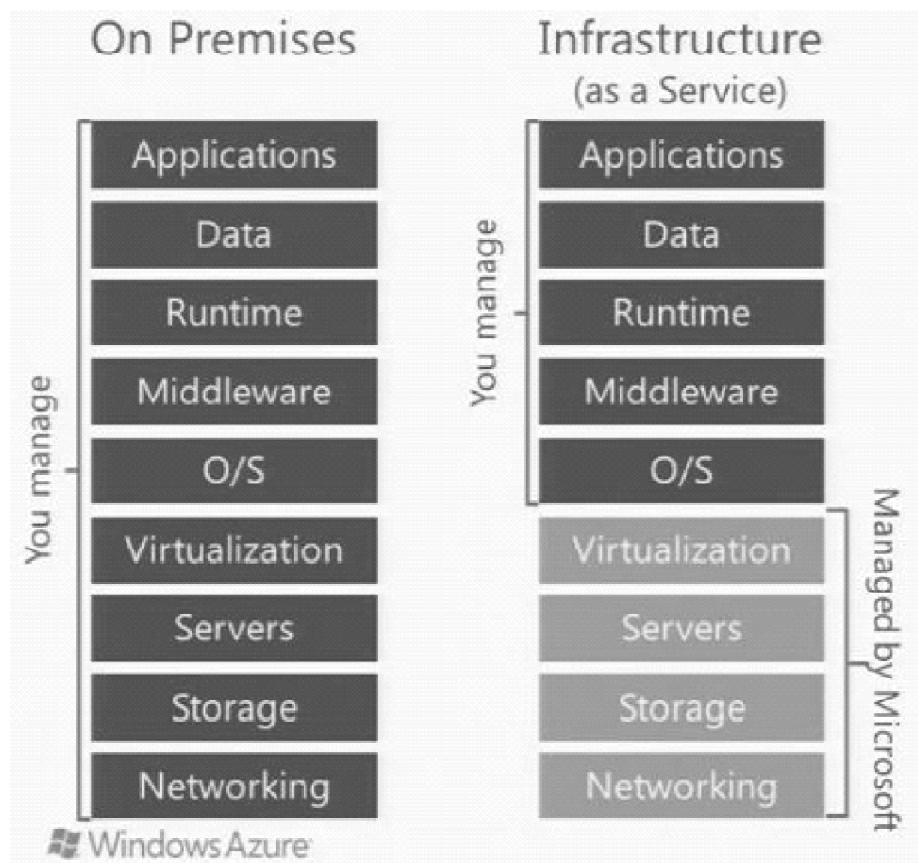

Figure 1.1 : Infrastructure As A Service explaining how Microsoft Manages IaaS

Source: Adamsync (2013). Windows Azure: Infrastructure as a Service. Retrieved from *https://adamsync.wordpress.com/2013/02/28/windows-azure-infrastructure-as-a-service/*

The following are the vendors providing Infrastructure-As-A-Service cloud computing model.

- Amazon AWS

- Microsoft Azure

- Google Compute Engine

- RackSpace

- OpenStack

To study the rate of IaaS adoption in organizations in Bengaluru, India, we have considered widely adopted innovation adoption theoretical framework TOE(Technology–Organization–Environment) developed by Tornatzky and Fleischer. Van de Weerd I et al., (2016) has defined, Innovation as a new procedure, practice, object or idea that is considered as new by an entity or unit of adoption. IT Innovations in organizations are considered as enablers for improving organizational productivity, capacity, competitiveness and profits. TOE framework describes factors that affects technology adoption and its likelihood. The three contextual factors which effects acceptance and implementation of innovation in organizations are the technological factors, the organizational factors and the environmental factors (Tornatzky and Fleisher 1990).

The factors which constitutes TOE framework in three context are listed below.

Table 1.1
Overview of significant factors in ToE framework

Technological factors	*Organizational factors*	*Environmental factors*
Accessibility	Cloud knowledge	Advice of consultants and IT specialists
Complexity	Innovativeness	Advice of business network
Compatibility	Organizational size	Competitive pressure
Cost savings	Organizational readiness	Choice of skilled cloud vendors
Data security	Resistance to accept new technologies	Support from the Government
Observability	Top management support	Market scope
Perceived benefits		Service-level agreement
Relative advantage		Suppliers competences
Trialability		Supplier computing support
Technology readiness		Trading partner pressure
Uncertainty		

Source: Researcher Findings

OBJECTIVE OF THE STUDY

To study the influence of organizational factors on the adoption of Infrastructure-as-a-service (IaaS) in mobile device management software product organizations in Bengaluru, India.

2. REVIEW OF LITERATURE

Rehman M.H et al., (2017) has explored several research studies on cloud computing and found that the recent advancement in the Cloud computing technologies has provided opportunities to software vendors to provide the infrastructure-as-a-service, platform-as-a-service and software-as-a-service. The research study emphasized that there are factors which can impact the buying behavior of customers in procuring

software products. Van de Weerd I et al., (2016) discussed that there are three organizational factors, namely organizational size, organizational readiness, and top management support which effects the decision making process of adopting software as a service. Borgman H.P et al., (2013) explored both empirically and theoretically about the organizational factors which can influence an organization on its buying behaviour towards Cloud services.

TOE (Technology-organization-environment) framework is very important for determining factors influencing adoption process of cloud computing services. Cloud computing services mainly SaaS, IaaS, PaaS offer organizations several advantages such as minimizing costs, maintenance, re-provisioning of resources, thereby contributing to increase in the income. However, very less is known about the customer buying behavior of cloud computing services among organizations. Hsu P F (2013) has advocated Theoretical Foundation of TOE (Technology-Organization-Environment) Framework for acceptance and implementation of Cloud Computing services in enterprises.

Adoption of cloud computing services refers to the service level agreement to use cloud computing services as a new way of implementing technology . A new technological product or a new service solution related to specific technology ends in improving an organization's productivity, profits and competitiveness. Iahad N.A and Saedi A (2013), has argued the adoption adherence level by organizations. The main factors playing important role in adoption of cloud computing services are: compatibility, top management support, relative advantage, trialability, organization size, prior experience, innovativeness, industry, market scope, uncertainty, supplier effort. Alshamaila et al., (2012), Low et al., (2011), has studied that Cloud computing services has the ability to transform the way in which the IT related services are provided in organizations. However, the nature and quickness of this transformation, is quiet unclear.

The acceptance and implementation of evolving technologies still in its initial stages among the organizations is influenced by several factors such as organizational capability of sensing technology, perceived reduced cost, perceived relative advantage, perceived risks as well as perceived competitiveness among organizations are seen to have positive impact on its adoption. Tan M, Lin T (2012), Alam et al., (2011) advocated the same factors which are mentioned above.

The influence of Technological factors on Software Product Management due to cloud computing services is another aspect in adoption of cloud technologies. Bekker W (2008) carried out in finding the influence of situational factors on Software Product Management with regard to Customer buying behavior.

Majority of research work done reveals that factors of organizational context are the most important and widely studied variables for the acceptance of innovations in IT. This is in fact due to the factors of organizational context are the most important determinants of innovation in IT. Several scholars has done their research on organizational factors that can either adopt or reject innovations in the organization. As listed in Table 1, the main organizational factors that can influence the customer buying decision for adopting innovation are mainly organizational size, organizational readiness and top management support. To define the factors in organizational context involved in this study, we have reviewed the existing literature and defined them in both perspectives like general perspective and specific perspective focused on IaaS and cloud studies.

2.1. Top management support

In several researches, it has been found that the top management support is the major factors impacting the decision to adopt innovations in IT. If the top management support is more, then decision makers will attend meetings and contribute in decision making process involving adoption of innovation in IT such as IaaS adoption. When adopting IaaS, lot of changes in practices, processes, and integration with the existing IT infrastructure becomes necessary; therefore, top management support is one of the major enablers to influence an organization about the adoption of innovation in IT and it will also impact employees to participate and contribute in the innovation adoption or change processes. As stated by Oliveira et al., (2014), the support from the top management plays a major role for adoption of cloud services like SaaS because they directs "the resources allocation, the service integration, and the process re-engineering." Therefore, following Oliveira et al., (2014) and Sabherwal(2006), we can define top management support as an encouraging factor and positive enabler towards acceptance and implementation of IaaS in an organization.

2.2. Organizational readiness

From several researches, it has been observed that researchers have applied the theory behind organizational readiness to investigate the acceptance and implementation of innovations in IT. Iacovou C et al., (1995) has defined Organizational readiness as the readiness of organizational resources to accept and implement innovations in technologies. This theory is further divided into three parts, comprises of human aspects, infrastructure aspects and financial aspects.

Iacovou C et al., (1995) has defined financial aspects as monetary resources allocated to be used in adopting latest technologies. Majority of researchers considers these monetary resources in a generic sense for adopting innovations in IT, rather than being specific for a particular technology in IT. The human resources aspects can be defined as, the presence of people with the required technological skills to accept and use new technological innovations in IT. The infrastructure aspects can be defined as, the existence of similar IT infrastructure that provisions a platform on which new technological innovations in IT can be developed.

However, the impact of organizational readiness on the acceptance and implementation of IaaS is unclear. Few authors have discovered that organizations delay acceptance of technological innovations until they have procured all of the required resources.

Following the literature discussed above, organizational readiness can be defined as the existence of (a) monetary resources (b) human resources and c) already existing system or IT infrastructure on which applications pertaining to IaaS can be developed.

2.3. Organizational size

Research studies shows that size of an organization has an positive impact on an organization's will to accept and implement technological (IT) innovations. Low C et al., (2011) in their research study has proved the same result for the adoption of cloud computing deployment model SaaS.

Following Low C et al., (2011), we define the organizational size of each organization participating in our study, we have taken the total number of employees in an organization as quantitative measure. We

followed the well known definition of World Bank for defining the size of an organization. The three major categories are micro enterprises (1-9 employees); small enterprises (10–49 employees); medium enterprises(50–249 employees); and large enterprises(>250 employees).

3. HYPOTHESES

H1: The awareness level of the IT team related to IaaS will not influence the adoption of IaaS in the organization.

H2: The top management will not influence the adoption of IaaS in the organization.

H3: The availability of the required organizational resources such as financial, IT infrastructure or existence of IT expertise will not influence the adoption of IaaS in the organization.

H4: The organizational size or size of its IT unit will not influence the adoption of IaaS in the organization.

H5: The use of existing IaaS deployment will not influence the adoption of IaaS in the organization.

4. DATA COLLECTION AND METHODOLOGY

The study is based on quantitative data collected from the employees of IT team at the Bengaluru branch of Multi-national companies, the details of which are mentioned below. Data is collected using online questionnaire. All the respondents were made aware about the research project before they respond. A total of 40 questionnaires were sent, out of which 33 were received back with a response. All the factors were measured on a five-point scale stating the following things (Strongly Disagree (SD)=1, Disagree (D)=2, Neither agree nor Disagree (NAD) = 3, Agree (A) = 4, Strongly Agree (SA) = 5).

Table 4.1
Overview of surveyed organizations

	Organization characteristic				Informant Characteristics		
#	Sector	Employees	IT Staff	Financial Assets	Position	IaaS Awareness	Education
O1	IT	>15,000	>15,000	>$40 Billion	IT Manager	High	IT
O2	IT	2000	2000	$5 Billion	IT Admin	High	IT
O3	IT	>1800	>1800	$5Billion	IT Admin	Basic	IT
O4	IT	>1500	>15000	>$5Billion	IT Admin	Basic	IT
O5	Banking	>500	<400	$2Billion	IT Admin	Basic	IT
O6	IT	<250	<250	$700Million	IT Admin	High	IT
O7	IT	<200	<200	$500Million	IT Admin	High	IT
O8	IT	<100	<100	$400Million	IT Admin	High	IT
O9	IT	<40	<40	>$100Million	IT Admin	High	IT
O10	IT	<50	<50	>$200Million	IT Admin	Basic	IT

Source: Researcher Findings

5. DATA ANALYSIS AND FINDINGS

The analysis of data collected for all the parts of the questionnaire is done by using One-Way ANOVA, to test the stated hypotheses. The IBM SPSS (version 19) is used for the purpose.

5.1. Influence of IT team's awareness on IaaS adoption in the IT Organizations

Here the awareness level of the IT team related to IaaS in the organization influencing the adoption of IaaS is studied. One-way ANOVA analysis is carried out to find whether the awareness level of the IT team related to IaaS in the organization, represented as v1, has significant influence on the IaaS adoption in the organization, represented as v2. For this purpose, five categories has been used to classify respondents; Strongly Disagree (SD) = 1, Disagree (D) = 2, Neither agree nor Disagree (NAD) = 3, Agree (A) = 4, Strongly Agree (SA) = 5. The IaaS adoption in the organization is the dependent variable. The relevant portion of the SPSS output sheet is presented below test the above mentioned condition.

Table 5.1
ANOVA Analysis for the Awareness level of IT Team

v2

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.235	2	.118	.348	.023
Within Groups	9.132	27	.338		
Total	9.367	29			

Source: SPSS Output

5.1.1. Hypothesis

H1: The awareness level of the IT team related to IaaS will not influence the adoption of IaaS in the organization.

The accurate level of significance "p value" of ANOVA is represented as "Sig." in 6th Column in the table mentioned above. The significance level value defined by us is 5%, therefore, $\alpha = 0.05$ (this is derived after reviewing research literature of same type). The table shows that 'α' value is less than 'p' value. In fact, since p = 0.023 which is less than $\alpha = 0.05$, therefore null hypothesis is rejected and the alternative hypothesis is accepted. That means, the awareness level of the IT team related to IaaS will significantly influence the adoption of IaaS in the organization.

5.2. Influence of Top Management role on IaaS adoption in the IT Organizations

Here the top management of the organization role in influencing the adoption of IaaS is studied. One-way ANOVA analysis is carried out to find whether the top management of the organization's role, represented as v1, has significant impact on the IaaS adoption in the organization, represented as v2. For this purpose, five categories has been used to classify respondents; Strongly Disagree (SD) = 1, Disagree (D) = 2, Neither agree nor Disagree (NAD) = 3, Agree (A) = 4, Strongly Agree (SA) = 5. The IaaS adoption in the organization is the dependent variable. The relevant portion of the SPSS output sheet is presented below test the above mentioned condition.

Table 5.2
ANOVA Analysis for the Top Management Influence

v2

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.760	1	.760	2.474	.012
Within Groups	8.606	28	.307		
Total	9.367	29			

Source: SPSS Output

5.2.1. Hypothesis

H2: The top management will not influence the adoption of IaaS in the organization.

The accurate level of significance "p value" of ANOVA is represented as "Sig." in 6th Column in the table mentioned above. The significance level value defined by us is 5%, therefore, $\alpha = 0.05$ (this is derived after reviewing research literature of same type). The table shows that 'α' value is less than 'p' value. In fact, since p = 0.012 is less than $\alpha = 0.05$, the null hypothesis is rejected and the alternative hypothesis is accepted. That means, the top management will significantly influence the adoption of IaaS in the organization.

5.3. Influence of Organizational resources on IaaS adoption in the IT Organizations

Here the availability of the required organizational resources such as financial, IT infrastructure or existence of IT expertise influencing the adoption of IaaS is analysed. One-way ANOVA is carried out to find whether availability of the required organizational resources such as financial, IT infrastructure or existence of IT expertise, represented as v1, has significant impact on the IaaS adoption in the organization, represented as v2. For this purpose, five categories has been used to classify respondents; Strongly Disagree (SD) = 1, Disagree (D) = 2, Neither agree nor Disagree (NAD) = 3, Agree (A) = 4, Strongly Agree (SA) = 5. The IaaS adoption in the organization is the dependent variable. The relevant portion of the SPSS output sheet is presented below test the above mentioned condition.

Table 5.3
ANOVA Analysis for the availability of organizational resources

v2

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.539	2	.270	.825	.044
Within Groups	8.827	27	.327		
Total	9.367	29			

Source: SPSS Output

5.3.1. Hypothesis

H3: The availability of the required organizational resources such as financial, IT infrastructure or existence of IT expertisewill not influence the adoption of IaaS in the organization.

The accurate level of significance "p value" of ANOVA is represented as "Sig." in 6th Column in the table mentioned above. The significance level value defined by us is 5%, therefore, $\alpha = 0.05$ (this is derived after reviewing research literature of same type). The table shows that 'α' value is less than 'p' value. In fact, since p = 0.044 is less than $\alpha = 0.05$, the null hypothesis is rejected and the alternative hypothesis is accepted. That means, the availability of the required organizational resources such as financial, IT infrastructure or existence of IT expertisewill significantly influence the adoption of IaaS in the organization.

5.4. Influence of Size of the Organization on IaaS adoption in the IT Organizations

Here the organizational size or size of its IT unit influencing the adoption of IaaS is studied. One-way ANOVA analysis is carried out to find whether the size of the company or its IT unit, denoted as v1, has significant influence on the IaaS adoption in the organization, denoted as v2. For this purpose, five categories has been used to classify respondents; Strongly Disagree (SD) = 1, Disagree (D) = 2, Neither agree nor Disagree (NAD) = 3, Agree (A) = 4, Strongly Agree (SA) = 5. The IaaS adoption in the organization is the dependent variable. The relevant portion of the SPSS output sheet is presented below test the above mentioned condition.

Table 5.4
ANOVA Analysis for the Organizational Size or IT Unit

v2

	Sum of Squares	*df*	*Mean Square*	*F*	*Sig.*
Between Groups	.822	3	.274	.834	.048
Within Groups	8.544	26	.329		
Total	9.367	29			

Source: SPSS Output

5.4.1. Hypothesis

H4: The organizational size or size of its IT unit will not influence the adoption of IaaS in the organization.

The accurate level of significance "p value" of ANOVA is represented as "Sig." in 6th Column in the table mentioned above. The significance level value defined by us is 5%, therefore, $\alpha = 0.05$ (this is derived after reviewing research literature of same type). The table shows that 'α' value is less than 'p' value. In fact, since p = 0.048 is less than $\alpha = 0.05$, the null hypothesis is rejected and the alternative hypothesis is accepted. That means, the organizational size or size of its IT unit will significantly influence the adoption of IaaS in the organization.

5.5. Influence of existing IaaS deployment on IaaS adoption in the IT Organizations

Here the use of existing IaaS deploymentinfluencing the adoption of IaaS is studied. One-way ANOVA analysis is is carried out to find whether the use of existing IaaS deployment, represented as v1, has significant impact on the IaaS adoption in the organization, represented as v2. For this purpose, five categories has been used to classify respondents; Strongly Disagree (SD) = 1, Disagree (D) = 2, Neither agree nor Disagree (NAD) = 3, Agree (A) = 4, Strongly Agree (SA) = 5. The IaaS adoption in the organization is the dependent

variable. The relevant portion of the SPSS output sheet is presented below test the above mentioned condition.

Table 5.5
ANOVA Analysis for the use of existing IaaS deployments

v2

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.039	2	.020	.057	.345
Within Groups	9.327	27	.345		
Total	9.367	29			

Source: SPSS Output

5.5.1. Hypothesis

H5: The use of existing IaaS deploymentwill not influence the adoption of IaaS in the organization.

The accurate level of significance "p value" of ANOVA is represented as "Sig." in 6th Column in the table mentioned above. The significance level value defined by us is 5%, therefore, $\alpha = 0.05$ (this is derived after reviewing research literature of same type). The table shows that 'α' value is less than 'p' value.. In fact, since p = 0.345 is more than $\alpha = 0.05$, the null hypothesis is accepted. That means, the use of existing IaaS deploymentwill not significantly influence the adoption of IaaS in thee organization.

6. CONCLUSION

In this research paper, we made an attempt to answer the research question "How do organizational factors influence Adoption of Infrastructure-as-a-Service (IaaS) in Bengaluru, India with respect to Organizational factors for Mobile Device Management software product?" In particular, we found that IaaS awareness to IT team in Indian companies has influence for the adoption of IaaS technology and how the three organizational factors: organizational size, organizational readiness and top management support, impact the decision to accept or reject IaaS.

This paper makes several contributions that has both theoretical and practical implications for the adoption or rejection of IaaS by IT companies with respect to organizational factors. First, our study explored that support of top management is the essential for adoption of IaaS and in fact it is strongest enabler. The influence of support of top management on IaaS adoption suggests that managers with awareness and understanding towards IaaS should be appointed for adopting these IaaS. Second, we examined the relationship between size of the organization and IaaS adoption. The previous researches shows on IT innovation adoption assumes that size of organization has a positive impact on the adoption of innovations in IT. In support to this assumption, our research study shows that small to mid-sized enterprises (SMEs) are adopting IaaS more quickly than large companies, therefore size of the organization has positive impact on the adoption decision of IaaS. The third finding in our research study is readiness of organizations in terms of financial resources, human resources and infrastructure resources will positively impact the adoption of IaaS, this is also inline with existing studies on adoption of IT innovation that organizational readiness has a positive influence.

Future researches in organizational studies with respect to size of organization and readiness of organization in terms of financial resources, human resources, infrastructure resources with respect to adoptions of innovations in IT should also investigate the impact of different types of innovations in cloud computing services like Platform as a service (PaaS). Cloud Computing service providers in other developing countries can also use this research study to devise strategies pertaining to increase in IaaS adoption.

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