

# Examining the Influence of Decisive Factors on Organizations: Migration to On-Premise Software Product from Cloud Computing

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## **Abstract:**

Software products are available in two delivery models namely On-Premise and Cloud Computing. Software products which are installed on a computer hardware and available in the premises of the customers are known as On-Premise software. Software products which are installed in the datacenter of vendor and available to the customer over internet is known as Cloud computing model of software product. Organizations migrated or adopted cloud computing model of software product due various factors and benefits are now facing lots of challenges in their day-to-day operations. There are theories and frameworks like Technological-Organization-Environment framework which helps in determining the factors influencing customer's decision to adopt innovations by the organizations. In this paper, eight critical factors have been identified which are responsible for the organizations to migrate back to On-premise model of software product from cloud computing model of software product.

## **Article History**

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Interviews and Group discussions has been conducted in identifying and evaluating the factors which influences customer's decision to migrate back to On-Premise model of software product from Cloud Computing model of software product.

**Keywords:** On-Premise, Cloud Computing, Software product, Migration factors

## **1. Introduction**

Information technology industry has seen lots of tremendous changes over last few decades. During its evolution and with respect to hardware, it was Mainframes by IBM which dominated the industry. The size of these mainframes computers was very big, and it was very expensive too. Personal Computers or Desktops or Microcomputers evolved during 1970s

and 1980s. These were very least expensive and became de facto computer of choice for home and offices during mid-1990s. The most popular operating systems used for these computers are Windows, Linux, MacOSx. Then came the rise of Mobile computers like Laptops which allowed the user to go mobile. A user can carry this computer with him from one place to another without disturbing his work.

Smartphones are the recent innovations in the field of IT industry. These are more oftenly called as pocket computers and are very small in size.

Now with respect to Software, the evolution happened only into two models namely:

- i) On-Premise
- ii) Cloud Computing

### **1.1 On-Premise Model of Software product:**

Software products which are installed on computers or appliances and are physically available in the premises of customer are known as On-Premise software products. These products are available to end customers via downloads, ISOs, DVDs, CDs etc. The end user needs license key in order to use this [30]. Examples includes but not limited to operating systems like Linux, windows, Office applications like Microsoft office, Accounting softwares like FOCUS, Wings & Tally etc.

### **1.2 Cloud Computing Model of Software product:**

In Cloud Computing model of Software product, The Software product is installed in the data center of vendor who is the manufacturer of the software product. In this model, the software product and its services are available to the customer through internet [24]

Cloud computing services are majorly available in three forms and they are *Software-as-a-service*, *Infrastructure-as-a-service*, *Platform-as-a-service*.

- 1.1.1 [25] has defined SaaS(Software-as-a-service) is a type of cloud computing service model that provides virtualization of software applications. Ex: Google Apps, Office 365.
- 1.1.2 [26] has defined PaaS(Platform-as-a-service) is a type of cloud computing service model that provides virtualization of Operating systems. Ex: Windows, Linux.
- 1.1.3 [27] has defined IaaS(Infrastructure-as-a-service) is a type of cloud computing service

model that provides virtualization of computing resources. Ex: Servers, Storage and Networking hardware.

[1] has conducted research to understand how technology–organization–environment factors influences organizations to adopt cloud computing. Similarly, lot of research has been carried out by [5,6] with respect to organizational factors of technology–organization–environment framework in Indonesian organizations. In the last decade, most of the organizations adopted cloud computing due to various benefits it offers when compared to On-premise software product.

Organizations adopting or migrating to Cloud services from on-premise infrastructure should be very careful. Recent studies have shown that organizations are under constant Denial of Service and brute force attack on their cloud services. For Example, Microsoft office 365 is most widely adopted SaaS model for various office applications like email, word, excel, power point etc. [31] has discussed how Microsoft office 365 customers has been targeted for brute force attack. The analyst [32], has discussed how 29% of organizations having Microsoft office 365 accounts are compromised using account takeover attacks. The government policy is framed lately enforcing organizations to maintain the data locally in the territory of India [33]. Due to these kinds of attacks, performance, government regulations and other issues, organizations are migrating back to on-premise infrastructure from cloud computing. This is contradicting to our previous research done using technological–environment–organization framework [9] and sparked the need for conducting the research study for organizations migrating back to on-premise infrastructure from cloud computing services. The goal of this research paper is to explore and evaluate decisive factors influencing organizations to reject Cloud Computing model of Software product

and migrate back to On-Premise model of Software Product. To achieve this, we have conducted focused group discussion and interviews with customers who has migrated back to On-premise model of software product from cloud computing model of software product. Interestingly, we have found eight critical factors which influences organizations to migrate back to On-premise model of software product.

## 2. Theoretical Background

Research studies indicates that organizations will perform better when technological innovations are adopted and may succeed over their competitors [37]. An innovation is defined as an idea, practice, or object that is perceived as new by an individual or any other unit of adoption [38]. The most commonly used framework to study adoption of innovations by organizations is Technology-Organization-Environment developed by Tornatzky and Fleischer [39]. According to TOE framework, an innovation in information and communication technology is influenced by technological, organizational, environmental factors [40]. [41], in their research study states that TOE can be used independent of type of industry and size of organization. Therefore, in this research paper, the literature related to Technology-Organization-Environment framework have been used as theoretical reference.

### 2.1 Technology Context:

Technological context of an innovation describes its technical characteristics. There are two types of technological factors which influences the organizations to adopt IT innovation. They are internal and external technological factors. Internal technological factors are existing technologies in the organization and external technology factors are those which are available in the marketplace [1].The most significant technological factors that influences organization's decision for adopting innovations are

Relative advantage, Compatibility, Complexity, Trialability, Observability[2,5,10].

### 2.2 Organizational Context:

Organizational context refers to the characteristics of an organizations which influences adoption of IT innovation by the firms. They are top management support, organizational readiness, organizational size, Awareness level of IT employees [4,9,10]. For example, Top management support is enabler for adoption of cloud technologies, Managers with good experience of Cloud computing will adopt it [11].

### 2.3 Environmental Context:

The environmental context for an organization is the environment in which an organization operates. It consists of multiple stakeholders such as governing board members, business competitors, suppliers, customers, the government, etc. They can influence the organization's decision to adopt an innovation [42]. The most used factors which influences the organization decision are Competitive pressure, Business partner pressure, External support, Support from the Government, Service Level Agreement, Industry Type, Advice of IT Specialist [10,15,42].

## 3. Review of Literature

Cloud Computing is a great innovation in IT related software products, but it is not a right choice for every organization. In Table 3.1, we presented overview of Software-As-A-Service adoption studies which uses technology-organization-environmental factors to explain adoption of Software-As-A-Service. Table 3.1 is made based on a literature review. The following keys were used while searching in Google Scholar like "SaaS", "IaaS", "PaaS", "adoption", "cloud", "TOE" and "migration". It is evident that majority of research scholars has done their research on adoption factors for Software-As-A-Service cloud computing model.

[1]has done his research using TOE framework limited to Jordanian companies. The cloud adoption in Jordanian organizations is very low but they found it very useful. The results revealed that cloud computing makes eminent sense for SMEs; however, there are

significant technical, organizational and environmental issues which need to be tackled before cloud computing services are effectively used by organizations in Jordan. The identified technological

Authors	Theory/Framework	Study
[1]	Technology-Organization-Environment	Adoption
[2]	Technology-Organization-Environment	Adoption
[3]	Technology-Organization-Environment	Adoption
[4]	Technology-Organization-Environment	Adoption
[5]	Technology-Organization-Environment	Adoption
[6]	Technology-Organization-Environment	Adoption
[7]	Technology-Organization-Environment	Adoption
[8]	Technology-Organization-Environment	Adoption
[9]	Technology-Organization-Environment	Adoption
[10]	Technology-Organization-Environment	Adoption
[11]	Technology-Organization-Environment	Adoption
[12]	Technology-Organization-Environment	Adoption
[13]	Technology-Organization-Environment	Adoption

Table 3.1: Studies on Adoption of Cloud Computing with respect to SaaS. \*Author refers to the researchers mentioned in Bibliography section.

factors were security, privacy concerns, trust, and compatibility. On the other hand, the main identified organizational factors were culture, top management support, and characteristics of CEOs. Finally, the main identified factors that are hindering cloud computing adoption by organizations in Jordan from environmental standpoint were the need for regulatory framework and SLAs contractual agreements.

[2] has done his research study using 8 variables of TOE framework limited to Republic of China and they are relative advantage, complexity, compatibility, top management support, firm size, technology readiness, competitive pressure, and trading partner pressure. The findings revealed that relative advantage, top management support, firm size, competitive pressure, and trading partner pressure characteristics have a significant effect on the adoption of cloud computing. The study presents several key findings and

implications about the determinants of cloud computing adoption in the high-tech industry. The key findings are the variables and Whether a firm implements cloud computing in the high-tech industry depends on the firm’s technological, organizational, and environmental contexts.

[3]has also used TOE framework to study cloud adoption in TAIWAN and states that cloud adoption is significantly influenced by three factors “Perceived Benefits” and “IT capability” are positively related, while “Business Concerns” is negatively related to cloud computing adoption. According to [4,5,11] Organizational factors plays an important role in cloud adoption. They did their research study on Indonesian organizations and found that top management support is enabler for cloud adoption. [15]states that service availability and business continuity are the major concerns of businesses in case of security and privacy

breaches. Small businesses in developing economies need to take seriously the security issues in cloud computing when planning cloud migration and sufficient provisions must be in place to continue with business operations should there be a failure in the cloud services infrastructure.

Cloud computing is an innovation in IT but needs to be carefully adopted by the organizations. Organizations who has adopted cloud computing technologies are now migrating back to on-premise technologies. The most common reason is DDoS attacks on cloud services [31]. [33]has emphasized that government policies like local data retention laws are enforcing organizations to migrate back to on-premise technologies because cloud vendor's data centers are not available in the geography of country. Organizations migrate back to on-premises model of software product due to various factors. The Technological factors are Bill Surprise, Data RetentionLaws, Risk Mitigation strategies, performance, Unused monitoring hosts and non-technical factors are Licensing of Applications, Exit charges, Egress charges [34]. We have conducted Interviews and focused group discussion with organization who has migrated back to On-premise model of software product. It has been found that there are eight critical factors which influences the organizations to migrate back to On-premise model of software product. Table 3.2 lists the factors which influences the organizations to migrate back to On-premise model of software product from cloud computing model of software product.

### **3.1 Factors influencing organizations for migration to On-premise model of software product**

The outcome of focused group discussions and interviews with organizations has helped in exploring, evaluating and defining the factors responsible for migration to On-premise model of software product from cloud computing model of software product.

#### **3.1.1 Bill surprise**

This can happen due to various reasons such as

- i) The initial promotional offerings attracted the organizations in, but after some time the billings ends up being significantly greater than predicted [34].
- ii) If the computing resources or hosts are left idle and not being used but alive then it cost unnecessarily.
- iii) There might be some application bug due to which computing resources are getting auto scaled and costing unnecessarily.
- iv) Credentials of Cloud provider's service accounts got compromised and hackers increased the computing resources resulting in increase of cost.

#### **3.1.2 Performance of Software product in Cloud**

It is likely that Software product in cloud is not yielding the same expectation when compare to On-premise model of software product [34].

#### **3.1.3 Local data retention laws**

Organizations which are involved in business with federal customers, defense organizations, financial institutions, government organizations might be subjected to local data retention laws. Business dependency with these organizations will force organizations to get certified for certain industry compliance standards such as FIPS for federal and defense organizations. Financial institutions are subjected to data retention and reporting requirements of the Foreign Account Tax Compliance Act [35].

#### **3.1.4 Risk mitigation strategy**

Organizational risk mitigation strategy might enforce the organization to migrate back to On-premise model of software product in the following cases [36].

- i) Failure of service at Cloud provider's end
- ii) When the vulnerability test performed on software product reports security risk

- iii) In case, if DDOS (Distributed Denial of Service) attacks are successful in cloud provider’s environment
- iv) Scalability issues
- v) Legal Risk (Maintaining compliance with HIPAA, etc.)
- vi) Data Privacy

Organizations maintains two environments namely production and test. Unused development hosts which are part of test environment can end up being tremendously expensive if they are not monitored properly [34].

### 3.1.5 Monitoring the unused hosts

#	Critical Factors
1	Bill surprise
2	Performance of Software product in Cloud
3	Data retention laws
4	Risk mitigation strategy
5	Monitoring the unused hosts
6	Early termination charges
7	Licensing of OS and application
8	Exit charges or Data pull out charges from cloud provider

Table 3.2: Overview of Critical Factors

### 3.1.6 Early termination or leaving the cloud provider charges

There might be charges when organizations want to terminate or leave the cloud service early than what contract states [34].

### 3.1.7 Licensing of OS and application

When migrating OS and application from cloud to On-premise, organization has to check the details of licensing of OS and application to overcome licensing issues in On-premise model of software product [34].

### 3.1.8 Exit Charges or Provider’s Data pull out charges

Since the software application was running in the cloud, there might be data stored in cloud servers. An administrator has to pull out data from cloud and restore it on On-premise deployment. Most of the cloud providers charge per megabyte for data being pulled out from their servers. If the data is more then it

will cost more to pull out the data from cloud servers [34].

## 4. Research Methodology

In this research methodology, the approach followed is multiple case study. This will help to investigate how TOE factors influences organizations to migrate back to On-premise model of software product from cloud computing model of software product. [22]has explained the facts in dealing with multiple case studies, with this approach we can investigate the migration to On-premise model of software products by the organizations in real world context.

As shown in figure 4.1, we have focused our research study on eight TOE variables: Bill surprise, Performance of Software product in Cloud, Local data retention laws, Risk mitigation strategy, Monitoring the unused hosts, Early termination or leaving the cloud provider charges, Licensing of OS and application, Exit charges or Provider Data pull out charges. These variables are defined in review of literature to form the research design. [21]has

elaborated on how to shape the research design and with the help of this design, we have systematically compared and contrasted our findings in data analysis section for all cases of our research study. With our research method, we

both On-premise and cloud computing model of software product.

We have used the eight TOE variables namely Bill surprise, Performance of Software product in Cloud, Local data retention laws, Risk mitigation strategies, Monitoring the unused hosts, Early termination or leaving the cloud provider charges, Licensing of OS and application, Exit charges or Provider Data pull out charges and as well as the outcome variable (migrate) as conditions to determine the influenced organizations. [22]has explained that there is a need of minimum two different cases within each subgroup in order to supplement the theoretical replications across the groups with literal replication within each group.

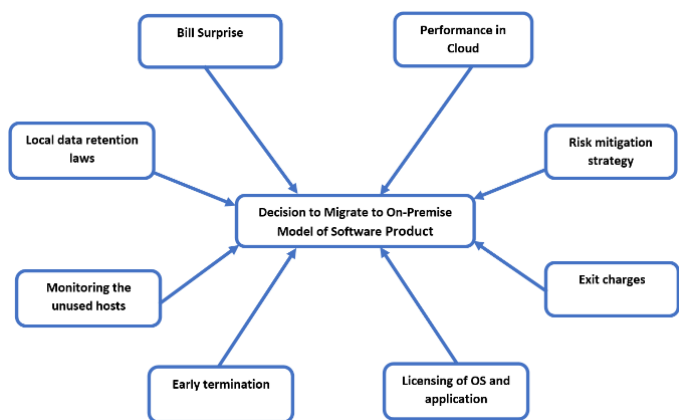


Figure 4.1 Framework displaying Cause-Effect of eight critical factors on Decision to Migrate to On-Premise Model of Software Product

intended to find why organizations are migrating back to On-premise model of software product from cloud computing model of software product.

#### 4.1 Case selection

This section discusses how we selected case companies for our research study. Since India is a developing country and has high presence of large multinational companies, all case organizations are multinational companies located in India. In our previous research, we have studied how organizational factors influences adoption of Cloud computing model of software product by SMEs and large organizations. The results of our earlier research are contradicting for large organizations and sparked special interest in studying why do large organizations migrate back to On-premise model of software product from cloud computing model of software product.

We have identified the case companies who are using Mobile Device Management, Salesforce, Exchange Online, Mobile Threat defense, SAP CRM software products. These software products are available in

We have invited different types of organizations to understand the influence of TOE variables in this research study. At the start of each interview session, there is formal introduction of both interviewer, participant and the purpose of the interview. The interviewer then explained the definitions of TOE factors and asked the participant about the influence of each variable in their organization’s decision. The interviewer assured participants that all information will be treated with confidentiality. With the request from participants, the organization names are not mentioned in the research paper. The organizations are represented as O1 - O20. The Audio-Visual recordings of interviews are recorded using Cisco Webex tool. In total, we have invited 30 companies out of which 20 has participated in the interviews and focused group discussion. Interestingly, it is found that 8 companies are migrated back to On-premise model of software product from cloud computing model of software product and 12 companies are not intending to migrate back to On-premise model of software product.

Table 4.1 has the overview of case organizations which has participated in the research study. These organizations are divided into different sectors. Thirteen of them are information technology

organizations represented as O7 to O20 and are multinational national companies situated in different parts of India. Two of them are banking organizations which are multinational companies and distributed across India. Few of them are Financial institutions, On-line shopping, Pharmaceutical institution and are multinational companies spreaded across India. Finally, the last case is an educational institution which is also located in India.

#### 4.2 Data Collection

[22], has discussed the framework on collecting the data using interviews and group discussions. In line with his work, we have used the similar technique of interviews and focused group discussion to collect

primary data. [20]has discussed on obtaining the information from interviewees and participants of focused group discussions. Inline to his work, we have used the same technique to obtain the required information from the participants. This has also given us a direction in understanding the influence of factors and decisions made by organizations in migrating back to On-premise model of software product. We have prepared interview guide which is used for all interviews and we kept on refining this guide after getting inputs from each interview.

Data collection was performed from the period March to December 2019. The interviews were done over Cisco webex and the video conferencing is recorded. In total, 20 interviews were carried out, the

Organizational Characteristics					Respondent Characteristics		
#	Industry Type	Employees	IT Staff	Total Assets (Dollars)	Migration status	Position	Education
O1	Banking	97,535	2710	1.72 Trillion	Migrated	Assistant Vice President	IT
O2	Banking	85,000	2360	2.374 Trillion	Migrated	IT Staff	IT
O3	Financial	10,000	300	3.15 Billion	Migrated	Manager	IT
O4	Education	1,200	50	10 Million	No	IT Staff	IT
O5	Pharmaceutical	1,26,000	2,500	133 Billion	No	IT Staff	IT
O6	Transportation	12,000	400	15.3 Billion	Migrated	Manager	IT
O7	IT	380,300	2,50,000	125.35 Billion	Migrated	Sr. Manager	IT
O8	IT	49,000	40,000	70 Billion	Migrated	Director	IT
O9	IT	4500	3500	1 Billion	Migrated	IT Staff	IT
O10	IT	1,60,000	90,000	11.68 Billion	Migrated	IT Staff	IT
O11	IT	8,071	6,000	5,482 Million	No	IT Staff	IT
O12	IT	120	100	20 Million	No	Manager	IT
O13	IT	1,24,000	80,000	241 Billion	No	IT Staff	IT
O14	IT	500	350	500 Million	No	IT Staff	IT
O15	IT	450	300	200 Million	No	IT Staff	IT
O16	IT	4,712	3,000	5 Billion	No	IT Staff	IT
O17	IT	1,200	1,000	1 Billion	No	Director	IT
O18	IT	1,200	1,000	1 Billion	No	Sr. Manager	IT
O19	IT	1,100	1,000	1 Billion	No	IT Staff	IT
O20	On-line shopping	5,66,000	28,385	131 Billion	No	Sr. Manager	IT

Table 4.1: Overview of Organizations



participants were from different management functions and included Assistant Vice Presidents, Directors, Senior Managers, IT Staff and this is presented in Table 4.1 also. All participants were informed about the critical factors influencing the decision to migrate back to On-premise model of software product. The interviewer explained the factors with examples to the participants. The interviewer assured the participants that the information will be kept confidential and companies are represented as O1 – O20 in Table 4.1.

## 5 Data Analysis and Findings

### 5.1. Data Analysis

For Data analysis, we have used eight codes to organize our data: Bill surprise(C1), Performance(C2), Local data retention laws(C3), Risk mitigation

strategies(C4), Monitoring the unused hosts(C5), Early termination or leaving the cloud provider charges(C6), Licensing of OS and application(C7), Provider Data pull out or Exit charges(C8). Table 5.1 explains the coding scheme used with description of code and examples of real text.

The data analysis took part in several iterations namely within-case analysis, qualitative comparative analysis and cross-case analysis. During within-case analysis, we have defined and evaluated individual cases separately using variables Bill surprise, Performance of Software product in Cloud, Local data retention laws, Risk mitigation strategies, Monitoring the unused hosts, Early termination or leaving the cloud provider charges, Licensing of OS and application, Provider Data pull out charges and outcome variable migrate. We have used field notes to refine our findings in each case analysis and found

Code	Description	Example
Bill surprise(C1)	Contains participant’s responses about the reasons on hike in the Bills of cloud service usage.	<i>“We were attracted by the initial offerings of cloud vendor. But lately we observed the actual rate is more than expected.” (O6)</i>
Performance(C2)	Contains participant’s responses about the reasons on performance of software product in cloud.	<i>“The performance of the application is not the same in cloud for the same configuration of computing resources.” (O7)</i>
Local data retention laws(C3)	Contains participant’s responses about the local data retention laws of firms.	<i>“We have moved back to On-premise servers because of compliance certifications and business dependencies with financial institutions.” (O1)</i>
Risk mitigation strategies(C4)	Contains participant’s responses about the corporate risk mitigation strategy in case of security threats and attacks.	<i>“To secure data, we moved data servers to On-premise and application to cloud. This approach has helped us in safeguarding the data.” (O2)</i>
Monitoring the unused hosts(C5)	Contains participant’s responses about the monitoring the hosts which are lying idle.	<i>“Its very tedious to monitor the test environment in the cloud. This is yielding to hike in bill.” (O10)</i>

Early termination charges(C6)	Contains participant’s responses about the termination charges to paid to cloud service provider in case of service termination.	<i>“We need to take in account service termination charges.” (O9)</i>
Licensing of OS and application(C7)	Contains participant’s responses about the licensing of OS and application in cloud and On-premise model.	<i>“The pricing differs in both cases. But it helped in long run in terms of growth since we moved back to On-premise servers.” (O3)</i>
Exit charges(C8)	Contains participant’s responses about the amount charged by the cloud service provider for downloading data stored in cloud servers.	<i>“Both the data storage and data download are of high concerns to us.” (O8)</i>

Table 5.1: Coding scheme

the reasons for organizations to migrate back to On-premise model of software product.

Qualitative comparative analysis is used in processing the outcome of within-case analyses in an informal way. [19], has defined qualitative comparative analysis as a method to find the group of conditions that are used in explaining a specific outcome. [18]has explained that qualitative comparative analysis can be used for within-case analysis and cross-case analysis, but these cases should be converted to configurations in order to compare them. These configurations are nothing but factors in our research study.

The findings are concluded with across-case analysis section. The results of qualitative comparative analysis form the basis to find the configurations that leads to migration or non-migration to On-premise model of software product. Across-case analysis is used to find identical patterns among different cases, this helped in concluding the influence of various factors in our study.

## 5.2. Data Validity

[22], has defined that there are four types of data validation that are important for evaluating the quality of research and they are construct validation, internal validation, external validation and reliability.

Construct validation provides correct measures to be used for a research study. The sources of construct validation used in this research study are (1)Group discussions, interviews, notes and documentation (2)Building chain of evidences during interviews and (3)Summarizing the results of individual case for feedback. Internal validation defines and evaluate the relationships discovered in the research study [22]. We have used explanation-building procedure in our study that strengthens the internal validation of data. Generalization of findings is known as external validation [22]. We have used replication logic of multiple case design to strengthen generalization of findings in our research study. In the last, the reliability of the research is ensured using database for each case study. This guarantees the analysis and data collection could be repeated [22].

## 5.3. Findings

The findings are presented in three parts namely within-case analysis, qualitative comparative analysis, across-case analysis. During with-in case analysis we have elaborated the results of each individual case. In qualitative comparative analysis, we have presented how different cases behaved for each influencing factor relating to outcome variable migration. In across-case analysis section, we have presented the identical patterns found across each case. We have

used Nvivo software for analyzing the data. This is inline with [29], *The Nvivo Qualitative Project Book*” and we have also used quotes from interviewees to illustrate our findings.

### 5.3.1. Within-case analysis

In within-case analysis, we have evaluated each individual case based on eight variables Bill surprise, Performance of Software product in Cloud, Local data retention laws, Risk mitigation strategies, Monitoring the unused hosts, Early termination or leaving the cloud provider charges, Licensing of OS and application, Provider Data pull out charges and also the outcome variable migration. The evaluation for these eight variables happened in two parts: first, we have assigned a measurable value to the variable and then acquired the value from either interview or group discussion. For example, for a given configuration of computing resources, the performance of mobile device management application is assigned as number of requests per second and we acquired its value from the participants during interviews. For respondent O8, “The number of user check-in attempts for On-premise server is 40 per second whereas it is just 25 in cloud for same amount of computing resources.” For the variable local data retention laws, we present our analysis from O1. The informant in this case states that “we migrated to On-premise servers for data storage still maintaining the mobile device management application server in the cloud. This gives a hybrid solution and solves the business dependencies with federal customers”. For the variable bill surprise, we present our analysis using case O6, the respondent in this case states that “we directly adopted cloud solution for mobile device management software product due to its initial offerings but the actual rate was not inline with the forecasted amount. So, we migrated back to On-premise servers”.

For the variable risk mitigation strategy, we present our findings from the analysis of case O2. The

respondent in this case states that “we migrated back to On-premise servers because of our corporate risk mitigation strategy. Brute force attacks cannot be handled in cloud environment for office 365 accounts”. Similarly, for the variable monitoring unused hosts we have used findings from our case organization O3, the respondent stated that “we have two environments in the cloud namely test or user acceptance environment and production environment. We first test the upgrade of software releases in test or user acceptance environment then upgrade the production environment to ensure there is no down time due to bugs in the application. But, with this approach, we don’t monitor the unused test or user acceptance environment which are idle and yields in cost”. For the variable, early termination charges, we have presented our findings from case organization O9, the respondent states that “We signed up for 3 years contract for the same amount of billing but we got charged for terminating the contract before its completion”. Licensing of OS and application is another concern when organizations are moving from cloud to On-premise, for this variable we presented our findings with the help of case organization O10. The respondent says, “The cost is not the same for licenses of OS and mobile device applications in cloud and On-premise servers, we have paid extra cost during migration to On-premise solution”. For the variable Data Pull out charges, the respondent case organization O7 states that “We have been using cloud from past 5 years and had huge amount of data in cloud servers, the vendor has charged us for downloading the data when we were migrating back to On-premise servers.” Lastly, the assessment of the outcome variable (migration) is also based on the data provided by participants of case organizations.

### 5.3.2. Qualitative comparative analysis

This section includes classification of case organizations according to variables Bill surprise, Performance of Software product in Cloud, Local data

retention laws, Risk mitigation strategies, Monitoring the unused hosts, Early termination or leaving the cloud provider charges, Licensing of OS and application, Provider Data pull out charges and outcome variable migration. In line with the approach explained by [18], we have used the informal qualitative comparative analysis to illustrate our findings.

We have assigned values to each individual variable with either 0 or 1 indicating that the given outcome or condition is present if the value is 1 otherwise 0. This is inline with the approach mentioned by [18]. Table 5.2 illustrates the assignment of values to all variables

The database set of all case organizations are represented in Table 5.2 and it also represent our findings. A truth table is derived from Table 5.2 which summarizes all configurations of eight conditions namely Bill surprise, Performance of Software product in Cloud, Local data retention laws, Risk mitigation strategies, Monitoring the unused hosts, Early termination or leaving the cloud provider charges, Licensing of OS and application, Provider Data pull out charges which has influenced the organization’s decision to migrate back to On-premise model of software product.

#	C1	C2	C3	C4	C5	C6	C7	C8	Migration
O1	0	0	1	1	0	0	0	0	1
O2	0	0	1	1	0	0	0	0	1
O3	1	0	0	0	1	1	0	0	1
O4	0	0	0	0	0	0	0	0	0
O5	0	0	0	0	1	0	0	0	0
O6	1	1	0	0	1	1	1	1	1
O7	0	1	0	0	0	1	1	1	1
O8	0	1	0	1	0	0	0	0	1
O9	1	0	0	0	1	1	0	1	1
O10	0	0	0	1	1	1	1	0	1
O11	0	0	0	0	0	0	0	0	0
O12	0	0	0	0	0	0	0	0	0
O13	0	1	0	0	0	0	0	0	0
O14	0	0	0	0	0	0	0	0	0
O15	0	0	0	0	0	0	0	0	0
O16	1	0	0	1	0	0	0	0	0
O17	0	0	0	0	0	0	0	0	0
O18	0	1	0	0	0	0	0	0	0
O19	1	1	0	0	0	0	0	0	0
O20	0	0	0	0	0	0	0	0	0

Table 5.2: Database set of cases

Configuration	C1	C2	C3	C4	C5	C6	C7	C8	Migrated	Not Migrated
A: 00000000	0	0	0	0	0	0	0	0		7

B: 00001000	0	0	0	0	1	0	0	0	1
C: 00011110	0	0	0	1	1	1	1	0	1
D: 00110001	0	0	1	1	0	0	0	1	2
E: 01000000	0	1	0	0	0	0	0	0	2
F: 01000111	0	1	0	0	0	1	1	1	1
G: 01010000	0	1	0	1	0	0	0	0	1
I: 10001100	1	0	0	0	1	1	0	0	1
J: 10001101	1	0	0	0	1	1	0	1	1
K: 10010000	1	0	0	1	0	0	0	0	1
L: 11000000	1	1	0	0	0	0	0	0	1
M: 11001111	1	1	0	0	1	1	1	1	1

Table 5.3: Truth Table

Table 5.3 displays the possible combination of configurations. The configurations which are applicable are displayed and the configurations which are not applicable are not displayed in the table. All the configurations are found in our case organization database set. It is worth noting that the configurations C, D, F, G, I, J, M are leading to migration where as, the configurations A, B, E, K, L are not leading to migration.

### 5.3.3. Across-case analysis

This section contains the results of our interviews and focused group discussions. We have found the general patterns that elaborates the influence of variables on the organization’s decision to migrate back to On-premise servers. In each sub section, we have first discussed the concepts used to define the variables in our study and then discussed the findings, patterns generalizing them. Finally, we have discussed our findings for outcome variable migration in our study.

#### 5.3.3.1 Bill Surprise

Five of our case organizations were actually influenced with this factor. Three (O3, O6, O9) out of them migrated back to On-premise servers where as the remaining two (O16, O19) did not migrated.

“Bill surprise generally happens because the initial promotional offerings attracted the organizations in, but after some time the billings ends up being significantly greater than predicted”. The case organizations (O6) is a leading transportation organization and they were highly influenced due to this reason which resulted to migration.

“Computing resources or hosts are left idle and not being used but alive then it cost unnecessarily”. The case organizations (O9) is having different environment like user acceptance environment and production environment. After each release from the vendor, they first test the upgrade on user acceptance environment and if it works fine, then they upgrade the production environment, but the resources of user acceptance test environment are left idle which causes bill surprise. This was the main reason for their decision to migrate back to On-premise servers.

“It was application bug due to which computing resources are getting auto scaled and costing unnecessarily”. This was stated by the case organization (O3) which is a financial institution.

The case organization (O19) states that “Credentials of Cloud provider’s service accounts got compromised and hackers increased the computing resources resulting in increase of cost”. But later on the vendor discounted their bill and this was the reason why they

did not migrate back to On-premise solution.

### 5.3.3.2 Performance of Software product in Cloud

Six case organizations who has participated in this research study was influenced with this factor. Three (O6, O7, O8) out of them has migrated back to On-premise model of software product whereas other three (O13, O18, O19) did not. It is likely that Software product in cloud is not yielding the same performance when compare to On-premise model of software product.

“Performance can be defined as number of request an application is processing for a given amount of time and computing resources”. This was quoted by case organization O7 which is large IT organizations. Ultimately, they have to migrate back to On-Premise because the end users were not able to access the application during its peak hours. The other two cases O6, O8 followed the same and migrated back to On-premise servers.

The other case organizations did not migrated back due to the fact that they have only few teams accessing the application in the cloud. But they have plans to move back to On-premise in next 3 years considering their growth aspects and number of users getting impacted due to performance. The case organization O19 is working with vendor for performance issues and they were informed that there are performance bugs in the application which will be resolved in next release of the application.

### 5.3.3.3 Local data retention laws

In this research study, there are two(O1, O2) case organizations which were influenced by this factor. Organizations which are involved in business with federal customers, defense organizations, financial institutions might be subjected to local data retention laws. Business dependencies with these organizations will force organizations to get certified for certain industry compliance standards such as FIPS for federal and defense organizations. Financial

institutions are subjected to data retention and reporting requirements of the Foreign Account Tax Compliance Act (FATCA).

“It was the FATCA certification for which have migrated back to On-premise solution” said case organization (O1) which is large banking organization.

### 5.3.3.4 Risk mitigation strategies

In this research study, there are five cases (O1, O2, O8, O10, O16) which have been influenced by this factor. Four case organizations (O1, O2, O8, O10) have migrated to On-premise model of software product where as one (O16) did not migrated.

Organizational risk mitigation strategy might enforce the organization to migrate back to On-premise model of software product in the following cases: Failure of service at Cloud provider’s end, When the vulnerability test results reports security risk, if DDOS (Distributed Denial of Service) attacks are successful in cloud provider’s environment, Scalability issues, Legal Risk (Maintaining compliance with HIPAA, etc.), Data Privacy.

The case O1 which is large banking organization says that “it was the legal risk which has enforced us in migrating back to On-premise servers”. The case organization (O16) did not migrated because the Cloud service provider is responsible for fixing all security issues found in application and restoring the services in case of attacks.

### 5.3.3.5 Monitoring the unused hosts

Five case organizations (O3, O5, O6, O9, O10) has been influence with this factor in our study. Four (O3, O6, O9, O10) out of them has migrated back to On-premise model of software product where as one (O5) did not migrated.

Organizations maintains two environments namely production and user acceptance test. Unused development hosts which are part of user acceptance

test environment can end up being tremendously expensive if they are not monitored properly.

The organization (O3) which is an large financial institution migrated back to On-premise server because of unused development host lying idle in the cloud service provider end. These unused hosts were not monitored and as a result became expensive.

The organization (O5) says that “Though we have unused hosts but we have automation to take care of this problem, our script will find the resources lying idle in the cloud service provider end and will bring them down if they are not in use for more than a week”.

#### **5.3.3.6 Early termination or leaving the cloud provider charges**

There are five case organizations (O3, O6, O7, O9, O10) which got influenced with this factor in our research study. All of these organizations migrated back to On-premise servers.

Early termination charges or leaving cloud provider charges in our study is defines as “These are the charges which a business has to pay to cloud service provider when organizations wants to terminate or leave the cloud service early than what contract states”. All the organizations irrespective of the industry in which they operate has to pay this amount. The best approach is to always refer the terms in contract before terminating the services.

#### **5.3.3.7 Licensing of OS and application**

In our research study, there are three case organizations (O6, O7, O10) which are influenced by this factor. All three of them migrated to On-premise model of software product.

Licensing of OS and application can be defined as, “Organization should check the details of licensing of

OS and application when migrating from cloud to On-premise to overcome licensing issues in On-premise model of software product”. The licensing is totally different in On-premise solutions; the features are sold as part of solution bundle which means organization has to pay for entire solution not just for OS and application.

#### **5.3.3.8 Exit charges or Provider Data pull out charges**

The case organizations (O6, O7, O9) are influenced with this factor. All three of them migrated to On-premise servers. The case (O6) which is a leading transportation organization says that “we have been using cloud since 5 years and has tons of data residing in cloud servers. We have paid the download charges when migrating back to On-premise servers”.

Since the software application was running in the cloud, there might be data stored in cloud servers. An administrator has to pull out data from cloud and restore it on On-premise deployment. Most of the cloud providers charge per megabyte for data being pulled out from their servers. If the data is more then it will cost more to pull out the data from cloud servers. The organization (O7) which is a leading IT service provider has stated that “Data is important for us and we cannot leave it in cloud since we terminated the contract, but it has costed us to bring the data from cloud servers to On-premise servers”.

#### **5.3.3.9 Migration to On-Premise software product**

In this research study, we have discovered the additional determinant responsible for organization’s decision to migrate back to On-premise servers. Apart from already defined variables the extra outcome variable is migration. The case organization (O1) which is a leading bank quotes that “Migration is successful only if all conditions resulting migration are taken care before start of the process”.

The other case organization (O3) says that “Migration

will happen, if the cloud services, terms and conditions are not thoroughly analyzed”.

## 6. Conclusion

### 6.1 Discussions

In this section, we discuss the influence of various TOE factors influencing organization’s decision to migrate back to On-premise technologies from cloud technologies. The most common factor for migrating cloud VMs back to On-premises is definitely "bill surprise." This generally happens because the promotional rates pulled the organizations in, but the actual rate ends up getting drastically higher than expected. Also, the other reason could be, if the resources are left idle and not being used but alive then it will cost unnecessarily, resources might get scaled up due to bug in the application. Credentials of cloud service providers got compromised and hackers increased the computing resources. In our research study we have found that Large organizations are migrating back to On-premise model of software product where are SMEs are not affected. Organizations which did not considered their growth aspects for next couple of years and adopted cloud solutions are facing similar situation and migrating back to On-premise model of software product.

It is found that, if performance of the software product in cloud is not yielding the same performance when compare to On-premise model, then organizations are migrating back to On-premise model and this can happen due to bug in the application or bug in the virtualization software even though computing resources are same in both cases. The other reason to migrate back to On-premise model is local data retention laws and risk mitigation strategies. It is found that organizations have to comply with certain acts like FATCA (foreign account tax compliance), HIPAA etc., for meeting security and data privacy standards when are involved in business with federal, defense or government organizations. Due to this,

most of the organizations are adopting hybrid model which means that they are running the application in the cloud but storing data on On-premise servers. In Summary, migration from cloud to On-premise is easy part but working out with provider data pull out charges, licensing of OS and applications are difficult part. However, the factors like Bill surprise, Performance of Software product in Cloud, Local data retention laws, Risk mitigation strategies, Monitoring the unused hosts influence the organization to take decision on migrating back to On-premise servers whereas the factors Early termination or leaving the cloud provider charges, Licensing of OS and application, Provider Data pull out charges will influence organizations during migration process.

### 6.2 Implications

In this research paper, we attempted to “explore and evaluate the factors influencing organizations to migrate back to On-premise model of software product from cloud computing model of software product”. We have investigated and found that the factors namely Bill surprise, Performance of Software product in Cloud, Local data retention laws, Risk mitigation strategies, Monitoring the unused hosts, Early termination or leaving the cloud provider charges, Licensing of OS and application, Provider Data pull out charges, influence the decision to migrate back to On-premise model of software product by the organizations.

This paper makes various contributions that has both theoretical and practical implications. First with regard to theoretical implications, we have investigated the factors which influences the organizations to migrate back to On-premise model of software product. Large organizations are migrating back to On-premise technologies due the factors like Risk Mitigation strategy, Distributed Denial of Service attacks whereas SMEs are migrating back to on-premise technologies due to factors like Bill Surprise, Performance (Stuart,



2017). Beyond theoretical implications this study also has practical implications. Government regulations for data retention in the geography of the country has large impact on the decision of organizations to migrate back to on-premise technologies. Apart from this, banking and financial institutions are adoption hybrid model of software product which means that applications will be running in cloud whereas data will be stored in on-premise infrastructure. With this approach they are in line with government regulations and comply to industry acts like FATCA. Finally, for SMEs cost saving is the main concern, The factor Bill surprise is the main reason for SMEs to migrate back to on-premise technologies.

### 6.3 Limitations

The limitations of this research study are as follows. The scope of this study is majorly IT industry, though we have other types of industries like Banking, Pharmaceutical, On-line shopping, Transportation, the number of case organizations are also limited to 20 covering different type of industries. Although, we have used replication to strengthen the reliability of our research study, several other types of industries are not included. To solve the issue of small amount of cases, one can use survey-based data collection method so that a greater number of organizations can be covered. The other limitation in Interviews based data collection method is if an interesting issue rises, it is not possible to ask follow-up questions. The other limitation is India is a developing country and the results may not be directly comparable with other developing nations because there might be different government regulations, Risk Mitigation strategies deployed there.

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