

# Cloud Computing For Micro, Small & Medium Scale Enterprises (MSMEs) In India

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**Abstract-** The micro, small and medium scale organizations in India are still in nascent state as far as use of IT systems is concerned, though they play a pivotal role in the overall industrial economy of the country. Further analysis of this problem reveals that there are number of barriers which come in the way of MSMEs adopting to new IT systems. They also lack the financial power required to adopt latest information technology and so cannot grow beyond a certain point. This paper analyses these barriers and discusses possibility of using Cloud Computing as a one stop solution. The barriers faced by MSMEs in adopting latest IT systems are actually enablers for adoption of cloud computing. But then there are other barriers faced by MSMEs in adopting to cloud computing. One main reason for MSMEs to ignore recent developments in information technology is lack of awareness. This paper critically analyzes enablers and barriers in adoption of cloud computing by MSMEs. It also attempts to create awareness, answering many concerns about cloud computing that can be used by MSMEs. It suggests use of cloud computing by MSMEs in India thereby reducing upfront investments, costs and improving efficiency and flexibility.

**Index Terms-** Cloud computing, MSMEs, Information Technology

## I. INTRODUCTION

Micro, Small and Medium Scale Enterprises are defined by the Reserve Bank of India (Reserve Bank of India, 2006-07) as follows-

For Enterprises engaged in the manufacture or production, processing or preservation of goods - "A micro enterprise is an enterprise where investment in plant and machinery does not exceed Rs 25 lakh; A small enterprise is an enterprise where the investment in plant and machinery is more than Rs. 25 lakh but does not exceed Rs. 5 crore; and A medium enterprise is an enterprise where the investment in plant and machinery is more than Rs.5 crore but does not exceed Rs.10 crore. "

For Enterprises engaged in providing or rendering of services - "A micro enterprise is an enterprise where the investment in equipment does not exceed Rs. 10 lakh; A small enterprise is an enterprise where the investment in equipment is more than Rs.10 lakh but does not exceed Rs. 2 crore; and A medium enterprise is an enterprise where the investment in equipment is more than Rs. 2 crore but does not exceed Rs. 5 crore."

Cloud computing is computing using shared resources that are delivered as service over internet and charged based on usage. The resources can be infrastructure as a service (IaaS), software as a service (SaaS) or platform as a service (PaaS). Users can access the services using thin clients or even mobile devices. Infrastructure as a service delivers infrastructure in terms of servers, firewalls, switches, routers and other hardware/networking components including virtualization. Software as a service provides software like ERPs, E-commerce and CRMs. Platform as a service allows organizations to select their IT platform - mostly the operating system (MS-Windows, Unix, Linux etc.) and environments (like Java, .Net etc.).

## II. RESEARCH ELABORATION

### 2.1 Statement of the problem and Objectives:

#### 2.1.1 Statement of the problem:

All organizations in today's world should adopt the latest in information technology to be competitive for sustainability and growth.

However, adoption of the latest in information technology by MSMEs in India is low. It is affected by a number of enablers and barriers. The barriers are outweighing the enablers resulting in limited penetration of such systems in MSME sector.

Cloud computing offers a solution to this problem as most of the barriers are eliminated but this also gives rise to a new set of barriers.

The enablers and barriers for adoption of the cloud computing by MSMEs in India needs to be critically analyzed. This will help the industry to decide the way forward towards adopting the cloud computing and thereby availing the latest in information technology.

#### 2.1.2 Objectives:

2.1.2.1 Critically analyze the enablers faced by MSMEs in adoption of cloud computing in India.

2.1.2.2 Critically analyze the barriers faced by MSMEs in adoption of cloud computing in India.

### 2.2 Conceptual Framework

For adoption of IT systems, as per traditional approach, the organizations need to go through huge efforts as explained in the following paragraphs.

The organizations must have their own servers. This requires a specialized server room (also called data center) to commission the servers. The servers need to have a platform for it to work. The platforms are mainly the operating systems - it

can be MS Windows, UNIX, Linux, Solaris or any other operating system. Apart from this, it requires a software development environment like Java or .Net. This platform and the environment are of no use unless there are applications running on the same. So the organizations need to conduct a requirement analysis and decide applications. The applications can range from a simple e-mailing solution or a financial package to complex ERPs and E-commerce systems. Even after organization deploying all this, the users need to be able to access the applications and so the organizations require IT networking done.

At this stage, users can access applications and the organization can be said to have adopted information technology. But then, there are still uncertainties and risks in terms of high maintenance and chances of failure. By now, the organizations must have spent huge amount of money, time and efforts without getting substantial benefits from the same. This can be easily managed by large organizations with sufficient IT budgets on hand. But the micro, small and medium scale organizations cannot afford to invest heavily into the information technology. Also they cannot sustain the higher maintenance costs or failures.

Cloud computing is computing using shared resources that are delivered as service over internet and charged based on usage. This means MSMEs can avoid upfront huge capital investments. This is a great relief to them. The systems are readily available on cloud thereby saving implementation time. Cost is based on 'Pay per usage' so organizations can have a great control over costs without worrying about maintenance costs. This does not require skilled resources or expertise as the cloud service provider takes care of the same. The risk of failure is minimized as there is no huge capital investment which would go waste in case of failures. The MSME can easily switch the service provider if the requirements are not met.

So conceptually, Cloud-computing dissolves all the barriers in adoption of latest information technology by MSMEs. In fact, those can be considered as enablers for adoption of cloud computing by MSMEs. But then, there are some barriers still existing.

This paper critically analyzes enablers and barriers for adoption of cloud computing by MSMEs in India.

### 2.3 Literature review

According to Miller Michael [7], if you are using even the web based e-mail applications like Gmail or Hotmail, you are already computing in the cloud. That changes the way you work and collaborate online. Compare this with the desktop based e-mail program (MS-Outlook) to understand the difference.

OECD, United Nations. Economic Commission for Latin America and the Caribbean [10] in the book 'Latin American Economic Outlook 2013 SME Policies for Structural Change' mention that cloud computing is an opportunity for SMEs, since it significantly reduces the weight of ICTs in their cost structures. Cloud computing gives SMEs the opportunity to access low-cost, standardized, configurable online computer services. These services include computing, storage, software and data management using shared physical and virtual resources (networks, servers and applications).

According to Zaigham Mahmood [6], SMEs across geographies and industries are making major changes to their

business models to be able to compete with larger firms by utilizing cloud services to improve operations and become more efficient. The adoption of cloud by SMEs initially have been driven by internal user demand and horizontal application development (e.g. Dropbox and cloud e-mail), where a trusted partner does add a value component to the implementation.

Masaaki Kurosu [4] has pointed out that, in recent years, many SMEs adopted various ERP packages from different ERP vendors, there is a new technology/ concepts available in ERP adoption for SMEs called cloud computing. Comparing to ERP, cloud computing seems like intangible because both hardware and software are not under control by the business who adopted this technology. Therefore, the key factors that impact acceptance of this technology by business will be a good research question. This is the area where this paper is contributing some insights.

Pang Chuan et. al, [2] have mentioned that with emergence of cloud concept, it can bring a great benefit to an enterprise especially for SMEs in terms of IT infrastructure. However, there are some risks and issues that need to be considered and explored when applying cloud computing. The adoption of e-business and cloud computing technologies and its development could lead to main changes in enterprises and its competitive space. These changes may create many opportunities for the enterprises to apply cloud computing successfully.

Sanjay Mohapatra & Laxmikant Lokhande [9] have mentioned a quote by Sharad Sanghi, CEO, Netmagic – 'You should be able to increase and decrease IT infrastructure and you should be able to pay for only what you use'. This described the cloud computing very well. They further add, with cloud computing, IT costs can be adjusted on demand. Thus, there is a business case for cloud computing. Cloud computing reduces the cost of investment and increases operational efficiency; this happens because the firms can engage its human resources to its core business areas. As a result, small and medium enterprises can get a head start in their business operations.

Alina Lonea et. al. [5] in their paper mentions the following - Small and medium-sized enterprises (SMEs) were the initial focus for cloud services and they are susceptible to a continuous adoption of cloud computing services, because of its strong advantages of accessing data from any place in the world over internet without concerning about the infrastructure used and the problems involved by the installation and maintenance processes, in order to assure an efficient expertise.

Reza Sahandi et. al. in their paper [11] mentioned about the survey of SMEs in UK that they conducted, which shows SMEs interests in exploiting the cloud computing services but there are still some concerns with regard to security and vendor lock-in. This could have affected the speed of cloud computing being adopted. Cloud computing is still a new technological venture for SMEs, but it takes good business sense and appropriate steps to fully reap its benefits. Whenever security, data privacy, interpretability, and portability standards ameliorate, cloud computing adoption will proliferate.

Carolyn Begg and Tom Cairn [1] in their paper believe that the lack of attention given to SMEs by the data governance community is unwise given the significant contribution this sector makes to economies worldwide. In addition, SMEs need to recognize the value of their data and importance of data

governance for their own survival in an increasingly digital business environment. It is likely that SMEs will continue to increase their use of IT, and e-business systems in particular, and this will bring growing amounts of data that requires governance.

Richard Millham [8] in his paper points out that cloud computing is particularly advantageous to small-to-medium sized enterprises (SME's) because they have access to enterprise systems at a fraction of the cost without requiring the resources or expertise to host these systems in-house. The paper further focuses on enabling legacy systems to adapt to new technology; in particular, demonstrating methods, such as wrapping of these systems, to enable legacy systems to migrate to the cloud paradigm. However this is only one part. Legacy systems in their original or their migrated paradigm must be able to adapt to business changes that their legacy system model as well.

## 2.4 Research Methodology

The study is based on analytical, qualitative, applied, Empirical and one time Field research. It is descriptive and exploratory research based on data collected during October 2014 to March 2015 from MSMEs in Navi Mumbai region.

Main methods of data collection are

- i. Primary Data -
  - a. Interviews of management of MSMEs
  - b. Discussion with IT industry practitioners
- ii. Secondary Data -
  - a. Annual reports of companies
  - b. Reports published by government agencies
  - c. Industrial data publications by various industry bodies
  - d. Journals, research papers, white papers & articles
  - e. Internet and print media
  - f. Relevant case studies

The Universe size of the data was 2292 MSME units in Navi Mumbai. Using Krejcie and Morgan table, the sample size derived was 330. Total data from 341 samples was collected using random sampling. The data collection was done through questionnaire using personal interviews and schedules.

## 2.5 Research Model

### 2.5.1 Hypothesis testing

- i. The researcher identified ten factors affecting positively (Enablers) for adoption of cloud computing by MSMEs. Based on this, following hypothesis was constituted.

H1 => Willingness to adopt cloud computing is a function of following enablers:

- i. Low cost
- ii. Low time
- iii. Improves Company Image
- iv. Low risk of failure
- v. Improves Information availability
- vi. Improves overall quality of information
- vii. Low resources requirement
- viii. Improves customer satisfaction & sales
- ix. Keep up with competition
- x. Low Complexities

This hypothesis was tested using the descriptive analysis.

Each of the enablers was considered as an independent variable and with willingness to adopt cloud computing as a dependent variable, correlation was found. Further the regression analysis was performed to estimate the relationship among enablers.

- ii. The researcher identified ten factors affecting negatively (barriers) to the adoption of cloud computing by MSMEs. Based on this, following hypothesis was constituted.

H2 => Willingness to adopt cloud computing is a function of following barriers:

- i. High Operative Cost
- ii. Awareness not available
- iii. Data Security concerns
- iv. Dependency on service providers
- v. Dependency on internet speed
- vi. Compulsory upgrades to latest technology
- vii. Minimum fixed cost irrespective of usage
- viii. Legal & compliance issues
- ix. Increasing costs every year
- x. Flexibility issues

This hypothesis was tested using the descriptive analysis. Each of the barriers was considered as an independent variable and with willingness to adopt cloud computing as a dependent variable, correlation was found. Further the regression analysis was performed to estimate the relationship among barriers.

## III. RESULTS & FINDINGS

### 3.1 Results, Findings and Discussion

#### 3.1.1 Results of testing hypothesis H1: Correlation between Positive Factors (Enablers) and willingness to adopt cloud computing:

Based on analysis of the data, the following results are obtained. The findings are discussed below:

3.1.1.1 Correlation between willingness to adopt cloud computing and Positive Factor (Enabler): Low cost  
 $r = 0.813$ .  
 $p\text{-value} = 0.000$

This indicates the strong positive correlation between willingness to adopt cloud computing and 'low cost' as enabler.

This is the only factor having strong positive correlation with willingness to adopt cloud computing. This finding further stresses that cost is the most important parameter for decision making of SMEs. In other words, the biggest advantage of adoption of cloud computing for SMEs is the low cost

3.1.1.2 Correlation between willingness to adopt cloud computing and Positive Factor (Enabler): Low time  
 $r = 0.502$   
 $p\text{-value} = 0.000$

This indicates the moderately positive correlation between willingness to adopt cloud computing and 'low time' as enabler.

This clearly indicates that MSMEs are not much concerned about time to implement cloud computing. This is contrary to

researcher's observation of large organizations for whom the time to implement the cloud computing matters a lot. This is due to the perceived impact of implementing cloud computing on the overall business which differs between MSMEs and large scale organizations.

### 3.1.1.3 Correlation between willingness to adopt cloud computing and Positive Factor (Enabler): Improves Company Image

$r = 0.590$   
 $p\text{-value} = 0.000$

This indicates the moderately positive correlation between willingness to adopt cloud computing and 'improves company image' as enabler.

This result is expected as the MSMEs considered for this study are industrial units rather than service oriented organizations. Cloud computing is more beneficial for improving internal processes for industrial MSMEs though they do consider cloud computing as a factor in improving company image.

### 3.1.1.4 Correlation between willingness to adopt cloud computing and Positive Factor (Enabler): Low risk of failure

$r = 0.650$   
 $p\text{-value} = 0.000$

This indicates the moderately positive correlation between willingness to adopt cloud computing and 'low risk of failure' as enabler.

Most of the MSMEs do not have their own IT systems or have minimum required computerization. In such cases, the risk of failure due to adoption of cloud computing is low. This is as against the case of large organizations who have huge IT systems running their core business functions and adoption of cloud computing may disrupt the normal functioning.

### 3.1.1.5 Correlation between willingness to adopt cloud computing and Positive Factor (Enabler): Improves Information availability

$r = 0.741$   
 $p\text{-value} = 0.000$

This indicates the moderately positive correlation between willingness to adopt cloud computing and 'improves information availability' as enabler.

MSMEs do agree that adoption of cloud computing will improve information availability. This is due to multiple reasons. The cloud computing can be accessed from almost anywhere and anytime with availability of client and internet. This enables users to access IT systems on the go from their laptops or mobile devices. The systems are available 24x7 improving information availability.

### 3.1.1.6 Correlation between willingness to adopt cloud computing and Positive Factor (Enabler): Improves overall quality of information

$r = 0.670$   
 $p\text{-value} = 0.000$

This indicates the moderately positive correlation between willingness to adopt cloud computing and 'improves overall quality of information' as enabler.

The cloud services make the information available in different formats due to availability of various software and tools which may be free or paid based on the service provider. This includes data analysis, business intelligence, data warehousing and social media enablement. This improves quality of information available from cloud computing.

### 3.1.1.7 Correlation between willingness to adopt cloud computing and Positive Factor (Enabler): Low resources requirement

$r = 0.441$   
 $p\text{-value} = 0.000$

This indicates the moderately positive correlation between willingness to adopt cloud computing and 'low resource requirement' as enabler

MSMEs are mainly concerned about costs and resource cost is an important parameter in MSME business management. Availability of expert resources is a main concern and so is the cost to retain them. Cloud computing frees MSMEs from this problem as the service providers take care of most of the technology issues. MSMEs just need to specify their requirement and start accessing the systems. This results in low resource requirement by adoption of cloud computing.

### 3.1.1.8 Correlation between willingness to adopt cloud computing and Positive Factor (Enabler): Improves customer satisfaction,

$r = 0.473$   
 $p\text{-value} = 0.000$

This indicates the moderately positive correlation between willingness to adopt cloud computing and 'improves customer satisfaction' as enabler.

Customers expect 24x7 system availability with quality information and ease of access. This was till now only possible for large organizations with high IT budgets. With availability of cloud computing, now MSMEs can also make the high availability and feature rich customer facing systems and improve customer satisfaction.

### 3.1.1.9 Correlation between willingness to adopt cloud computing and Positive Factor (Enabler): Keep up with competition

$r = 0.638$   
 $p\text{-value} = 0.000$

This indicates the moderately positive correlation between willingness to adopt cloud computing and 'keep up with competition' as enabler

Large organizations adopt the latest information technology and maintain their market positions. It is extremely difficult for MSMEs to compete with them. With advent of cloud computing, it is now possible for MSMEs to utilize similar systems at much lower costs. Also some of the MSMEs have already adopted cloud computing and getting benefited from the same. In order to keep up with competition, remaining MSMEs need to adopt cloud computing as soon as possible.

### 3.1.1.10 Correlation between willingness to adopt cloud computing and Positive Factor (Enabler): Low Complexities

$r = 0.457$

p-value = 0.000

This indicates the moderately positive correlation between willingness to adopt cloud computing and ‘low complexities’ as enabler

Every business is supposed to have core expertise in their business but to avail benefits of modern information technologies; they are forced to spend their efforts on information technology which are complex for them considering that is not their field of expertise. With cloud computing, as the service provider takes care of complexities of information technology, MSMEs can focus on their core business.

### 3.1.2 Regression analysis for positive factors (Enablers)

**Table 1: Analysis of variance for enablers for adoption of cloud computing by MSMEs**

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	10	386.778	38.6778	75.39	0
Low cost	1	50.665	50.6651	98.75	0
Low time	1	1.94	1.9404	3.78	0.053
Improves Company Image	1	0.226	0.2264	0.44	0.507
Low risk of failure	1	1.209	1.2092	2.36	0.126
Improves Information availability	1	7.945	7.9451	15.49	0
Improves overall quality of information	1	0.12	0.1199	0.23	0.629
Low resources requirement	1	7.489	7.4893	14.6	0
Improves customer satisfaction	1	0.003	0.0025	0	0.944
Keep up with competition	1	1.145	1.1448	2.23	0.136
Low Complexities	1	0.886	0.8862	1.73	0.19
Error	330	169.31	0.5131		
Lack-of-Fit	80	54.082	0.676	1.47	0.014
Pure Error	250	115.228	0.4609		
Total	340	556.088			

**Table 2: Model Summary for enablers for adoption of cloud computing by MSMEs**

S	R-sq	R-sq(adj)	R-sq(pred)
0.716282	69.55%	68.63%	67.51%

**Table 3: Coefficients for enablers for adoption of cloud computing by MSMEs**

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	0.309	0.325	0.95	0.342	
Low cost	0.4976	0.0501	9.94	0	4.02
Low time	-0.1795	0.0923	-1.94	0.053	2.61
Improves Company Image	-0.038	0.0572	-0.66	0.507	3.77
Low risk of failure	-0.1031	0.0672	-1.54	0.126	10.84
Improves Information availabili	0.3162	0.0804	3.94	0	6.12
Improves overall quality of inf	-0.055	0.115	-0.48	0.629	10.03
Low resources requirement	0.391	0.102	3.82	0	1.35
Improves customer satisfaction	0.008	0.115	0.07	0.944	2.95
Keep up with competition	0.1033	0.0691	1.49	0.136	11.49
Low Complexities	0.0513	0.039	1.31	0.19	2.17

### Regression Equation

$$\begin{aligned} \text{Willingness to adopt cloud computing} = & \\ & + 0.309 + 0.4976 \text{ Low cost} \\ & - 0.1795 \text{ Low time} \\ & - 0.0380 \text{ Improves Company Image} \\ & - 0.1031 \text{ Low risk of failure} \\ & + 0.3162 \text{ Improves Information availability} \\ & - 0.055 \text{ Improves overall quality of information} \\ & + 0.391 \text{ Low resources requirement} \\ & + 0.008 \text{ Improves customer satisfaction} \\ & + 0.1033 \text{ Keep up with competition} \\ & + 0.0513 \text{ Low Complexities} \end{aligned}$$

### 3.2 Effect of Negative Factors (Barriers)

#### 3.2.1 Correlation between Negative Factors (Barriers) and willingness to adopt cloud computing

3.2.1.1 Correlation between willingness to adopt cloud computing and Negative Factor (Barrier): High Operative Cost  
r = -0.669

P-Value = 0.000

This indicates the moderately negative correlation between willingness to adopt cloud computing and ‘high operative costs’ as barrier.

Cloud computing saves MSMEs from initial high capital investments but it also results into high operative costs. This high operative costs are relative and change from unit to unit based on usage patterns. But overall, high operative cost is a concern for MSMEs.

3.2.1.2 Correlation between willingness to adopt cloud computing and Negative Factor (Barrier): Awareness not available

r = -0.714

P-Value = 0.000

This indicates the moderately negative correlation between willingness to adopt cloud computing and ‘awareness not available’ as a barrier.

The researcher has observed that the MSMEs are really interested in adoption of latest information technology. But they do not have sufficient information or guidance about the ways to adopt cloud computing. The consulting firms and IT services firms are mainly interested in large organizations as their clients and MSMEs also cannot afford their charges.

3.2.1.3 Correlation between willingness to adopt cloud computing and Negative Factor (Barrier): Data Security concerns

r = -0.828

P-Value = 0.000

This indicates the strong negative correlation between willingness to adopt cloud computing and ‘data security concerns’ as barrier.

Data security concerns is the most important factor in decision making for cloud computing. Organizations always feel the data is secured when stored on the computers in their own data centers with all sorts of physical security measures. But they forget that in today’s networked world, physical security cannot secure the data. In fact, the data in the computers of the cloud service providers is much safer considering the latest security technologies they maintain and the legal agreements supporting data security.

3.2.1.4 Correlation between willingness to adopt cloud computing and Negative Factor (Barrier): Dependency on service providers

r = -0.608

P-Value = 0.000

This indicates the moderately negative correlation between willingness to adopt cloud computing and ‘dependency on service provider’ as barrier

The MSMEs perceive that cloud computing is provided by the cloud service provider thereby there will be dependency on the service provider. This is correct but the services provided are

governed by the legal agreement between the service provider and the client organization. There are stringent SLAs on the service provider and client organization can demand adequate compensations in case of any breaches. This makes the organizations safe. Also in case the client organization is still not satisfied with the performance of the service provider, they can switch to another cloud service provider. Considering stiff completion among the cloud service providers, switching is no more a problem.

3.2.1.5 Correlation between willingness to adopt cloud computing and Negative Factor (Barrier): Dependency on internet speed

$r = -0.491$

P-Value = 0.000

This indicates the moderately negative correlation between willingness to adopt cloud computing and 'dependency on internet speed' as barrier

Dependency on internet speed is a real concern as the cloud services are provided on internet. MSME organizations adopting to cloud computing need to select a suitable internet service provider for their staff to avail cloud based solutions. They can even select multiple internet service providers so that there can be uninterrupted services in case one of those fails. There are still concerns in the remote areas where internet is not available and in such cases, cloud computing cannot be utilized. Hence MSMEs need to consider this factor carefully.

3.2.1.6 Correlation between willingness to adopt cloud computing and Negative Factor (Barrier): Compulsory upgrades to latest technology

$r = -0.568$

P-Value = 0.000

This indicates the moderately negative correlation between willingness to adopt cloud computing and 'compulsory upgrade to latest technology' as barrier.

Cloud service providers typically provide latest OS versions and environments with up to date service packs and patches installed as recommended by the product vendors. This is in fact a useful feature. But this requires the software version upgrade as the existing software used by organization may not work in the upgraded environment. This results in additional costs and change management.

3.2.1.7 Correlation between willingness to adopt cloud computing and Negative Factor (Barrier): Minimum fixed cost irrespective of usage

$r = -0.713$

P-Value = 0.000

This indicates the moderately negative correlation between willingness to adopt cloud computing and 'minimum fixed cost irrespective of usage' as barrier

The cloud service providers have different payment models. The basis of payment in most cases is 'pay per usage'. But there are some hidden fixed costs just to maintain the data and accounts with service provider. This is inevitable and the costs are minimal comparing with maintaining own data center.

3.2.1.8 Correlation between willingness to adopt cloud computing and Negative Factor (Barrier): Legal & compliance issues

$r = -0.563$

P-Value = 0.000

This indicates the moderately negative correlation between willingness to adopt cloud computing and 'legal and compliance issues' as barrier

MSMEs and for that matter all the business organizations are busy with their core business and need not spend time and efforts of non-core areas. Cloud service providers host company's sensitive data and business critical systems and so insists on signing legal agreements. Also the organizations compliance policies may not be accepted by cloud service providers and need to be diluted. For e.g. some of the cloud service providers do not allow site inspection of their server facilities.

3.2.1.9 Correlation between willingness to adopt cloud computing and Negative Factor (Barrier): Increasing costs every year

$r = -0.564$

P-Value = 0.000

It is very obvious that the costs of services go on increasing every year due to inflation based on monetary indices. But the concern here is that the cloud service providers provide cloud services at highly discounted rates to their clients in the beginning to grab a new client. But from the next year, they start charging higher amounts with huge mark-ups and hidden costs. This practice causes the organizations to think that the operative costs are too high in subsequent years and so this factor becomes a barrier in adoption of cloud computing.

3.2.1.10 Correlation between willingness to adopt cloud computing and Negative Factor (Barrier): Flexibility issues

$r = -0.514$

P-Value = 0.000

Cloud computing provides high amount of technical flexibility. It can provide higher computing power, storage space and other technology areas very easily but this flexibility is restricted by the scope of services as defined in the legal agreement. So some specific requests of the client organization can be denied by the cloud service provider. Also the usage of cloud computing is restricted and the service provider can object for certain activities performed by client organization.

3.2.2 Regression analysis for negative factors (Barriers)

**Table 4: Analysis of variance for barriers in adoption of cloud computing by MSMEs**

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	10	490.707	49.0707	118.21	0
High Operative Cost	1	1.608	1.6082	3.87	0.05
Awareness not available	1	1.395	1.3948	3.36	0.068
Data Security concerns	1	70.659	70.6588	170.21	0
Dependency on service providers	1	0.872	0.8722	2.1	0.148
Dependency on internet speed	1	0.305	0.3045	0.73	0.392
Compulsory upgrades to latest technology	1	3.976	3.9763	9.58	0.002
Minimum fixed cost irrespective	1	3.372	3.3722	8.12	0.005
Legal & compliance issues	1	0.512	0.5117	1.23	0.268
Increasing costs every year	1	0.4	0.4003	0.96	0.327
Flexibility issues	1	0.027	0.0272	0.07	0.798
Error	330	136.994	0.4151		
Lack-of-Fit	131	97.294	0.7427	3.72	0
Pure Error	199	39.7	0.1995		
Total	340	627.701			

**Table 5: Model Summary for barriers in adoption of cloud computing by MSMEs**

S	R-sq	R-sq(adj)	R-sq(pred)
0.644307	0.7818	0.7751	0.7652

**Table 6: Coefficients for barriers in adoption of cloud computing by MSMEs**

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	6.592	0.12	54.96	0	
High Operative Cost	-0.0713	0.0362	-1.97	0.05	2.29
Awareness not available	-0.0868	0.0474	-1.83	0.068	3.55
Data Security concerns	-0.5674	0.0435	-13.05	0	2.34
Dependency on service providers	-0.0588	0.0406	-1.45	0.148	2.31
Dependency on internet speed	-0.0329	0.0385	-0.86	0.392	1.87
Compulsory upgrades to latest technology	-0.1152	0.0372	-3.09	0.002	2.14
Minimum fixed cost irrespective	-0.1213	0.0426	-2.85	0.005	2.83
Legal & compliance issues	-0.0449	0.0405	-1.11	0.268	2.02
Increasing costs every year	-0.0367	0.0374	-0.98	0.327	2.09
Flexibility issues	0.0086	0.0335	0.26	0.798	1.7

Regression Equation:

Willingness to adopt cloud computing =  
 6.592 - 0.0713 High Operative Cost  
 - 0.0868 Awareness not available  
 - 0.5674 Data Security concerns  
 - 0.0588 Dependency on service providers  
 - 0.0329 Dependency on internet speed  
 - 0.1152 Compulsory upgrades to latest t  
 - 0.1213 Minimum fixed cost irrespective  
 - 0.0449 Legal & compliance issues  
 - 0.0367 Increasing costs every year  
 + 0.0086 Flexibility issues

#### IV. CONCLUSIONS

##### 4.1 Conclusions

The MSMEs should adopt the cloud computing which will enable them to utilize the latest information technology.

The willingness to adopt cloud computing in MSME sector is function of multiple enablers and barriers. The main enabler is the low cost followed by information availability. The main barrier is concern about the data security followed by awareness.

##### 4.2 Scope for further research

Each of the enablers and barriers considered in this study can be further studied in depth from multiple dimensions.

##### 4.3 Managerial implications

The MSME management can consider this study as a viewpoint and can take steps towards adoption of cloud computing in their units. A step by step approach is recommended for MSMEs for venturing into the world of cloud computing rather than a big bang approach.

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