AN EXPLORATORY STUDY ON THE IMPACT OF CLOUD ADOPTION ON SMALL AND MEDIUM IT ENTERPRISES IN PUNE

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ABSTRACT
Cloud technology offerings are bringing plenty of benefits for companies who can't afford huge investments in their IT budget. Cloud technology with its key features of scalability, speed of deployment, agility, elasticity, and pay-as-you-go option is the preferred choice over traditional in-house IT setup. Companies are getting benefited due to the usage of this emerging technology.

Small and Medium enterprises (SMEs) play a significant part in the development of the nation by assisting in job creation and helping to grow the economy. Cloud technology is the perfect IT solution for SMEs. They do not need to have in-house IT experts as cloud providers take care of deployment and operational responsibilities to a great extent. Cloud services provider holds expertise and helps SMEs to get a better value proposition out of technology investment. SMEs can focus on their own core competencies to improve their services and operations with the usage of cloud technology.

Cloud providers are also benefited because of the economy of scale and assured dependency and commitment by their consumers with a lock-in period. Cloud providers and SMEs need to collaborate to select the right cloud offering which provides constant results and brings trust in relation while the core focus will remain on maximizing mutual business outcome. Cloud services have already proved their usefulness during the COVID-19 lockdown situation. The study outlines cloud technology basics and strategic advantages of the usage of cloud technology for SMEs
Keywords: SMEs, Cloud Technology, Cloud Adoption, Business Outcomes, IT strategy

Introduction

Digitalization of businesses is an emerging trend across the world. Technology such as cloud computing has removed many hurdles in usage of state of art technologies which were not within reach of small businesses (Djamila, 2022). Most businesses are using cloud technology in some or other form. Cloud technology adoption doesn't require a large capital sum but comes with minimal operational cost in the form of rent based on your usages. Its agility in deployment process, scalability and elasticity provide businesses a competitive advantage (Chang, 2019). These benefits bring effectiveness and efficiency in business operation support to increase the reliability and credibility of the organization (Bagiwa et al., 2016) . Cloud computing is helping organizations to perform business transformation to achieve better performance using digital platforms (Rahimli, 2013; HSU, 2014; Ali, 2016).

In the process of cloud adoptions, several studies have been conducted to understand the factors affecting cloud adoptions across developed and developing countries (Gutierrez, 2015). Cloud technology with its variety of service offering compromising a wide range of products on shelf increases its utility value as an innovative platform (Muhic, 2014). There are very few studies which have attempted to identify the correlation between various cloud adoption factors and their impact on business outcomes. The earlier studies from the literature reveal that they are more focused on predictors in the cloud technology adoption process but those are not linked to actual outcomes.

It has been observed that Small and Medium enterprises (SMEs) are vehicles of job production and key contributors to the economy across countries (Javalgi, 2011). According to the MSME ministry, SMEs contribute 38% of the overall country's GDP in India. This study aims to discover the linkage between cloud adoption influencing factors and their impact on the business performance of SMEs in the IT service sector in Pune.

There are many frameworks established by earlier researchers to find out influencing factors on cloud adoption. The most common framework used for assessing technology innovations is Technology-Organization-Environment (TOE). The TOE framework has been used by researchers as a holistic tool as it integrates many

aspects from various frameworks (Oliveira, 2010; Li, 2015). TOE consists of technological, organizational, and environmental aspects. This study utilizes the TOE framework to analyse the impact of cloud adoption on IT SMEs in Pune.

Various researchers proved that when an organization uses proper resources to their competitive advantage which boost the overall performance of the organization. Moreover, usage of technology resources also helped organizations to enhance their business outcomes.

The article covers introductory information about the research topic in the first section. The second section is for a literature review covering the definition of SME classification in India, cloud basics include essential characteristics of cloud technology, its service, and deployment models. The third section covers the theoretical framework with the benefits of cloud adoption for SMEs and the proposed technology deployment framework. The fourth section covers the research design, assessing the model fits and hypothesis validation results. The fifth section is about descriptive data analysis followed by the conclusion in the sixth section. The conclusion covers the important factors and their strategic significance to drive the most benefits out of cloud adoption for SMEs.

Literature Review

SMEs definition:

The micro, small and medium enterprises (SMEs) have significant impact on the India Economy. They are proved as strong agents for Socio-economic development of the country by contributing to employment, innovation, and exports. They contribute 45% of total industrial production, 30.50 % of services and 40 % of total exports into GDP.

The SMEs are broadly classified in the two categories

- Product oriented: Companies involved in manufacturing of goods or products in any of the industry verticals.
- Services oriented: Companies providing services as their offering.

The government and regulatory bodies are committed to remove the hurdles and provide a complete eco-system for development of SMEs in the region. In our country, the SMEs are defined based on their investment into plant and machinery or based on turnover in the fiscal year. The new definition has widened the limit to provide benefits to a large number of units.

	Classification Based On	
Type	**Investment (Not more than)**	**Annual Turnover (Not more than)**
Micro	Rs 1 crore	Rs 10 crore
Small	Rs 10 crore	Rs 10 crore
Medium	Rs 50 crore	Rs 250 crore

Table 1: MSME new definition for SME classification dated 1 July 2020

The Cloud Computing Characteristics, Service and Deployment Models

Cloud computing has five essential features with three service depictions and four deployment replicas as depicted in the below figure (Mell, 2011).

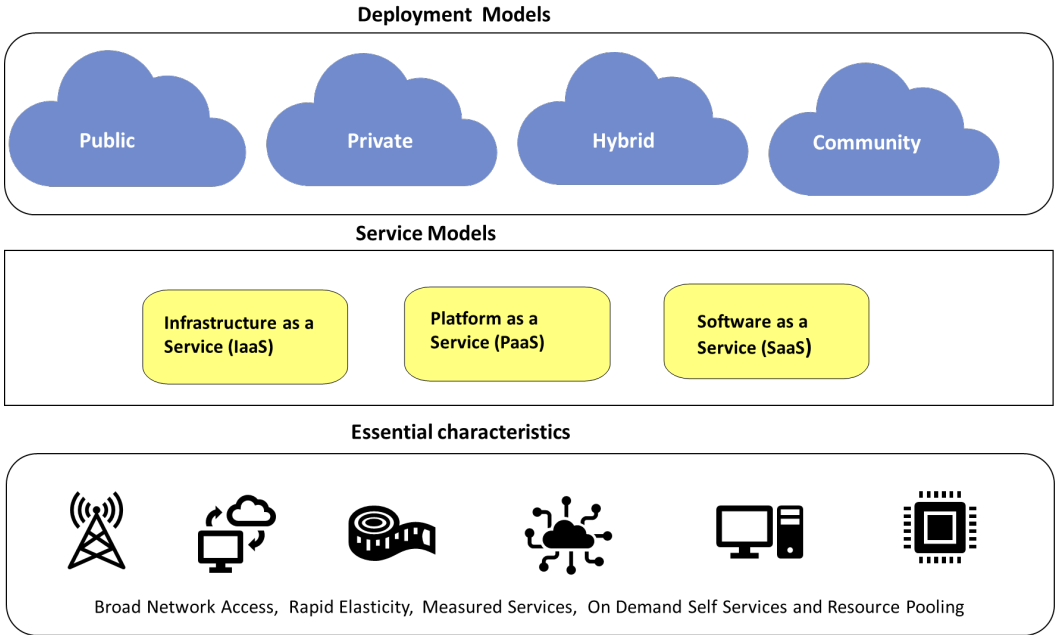

Figure 1 NIST model of cloud computing

Essential characteristics

Broad network access: Cloud computing services can be accessed via public or private networks. The cloud services can be consumed using low latency internet using front-end client software. The connectivity is possible using laptops, desktop, mobile phones and tablets. Nowadays, reliable internet connectivity is available round the clock which enables cloud consumers to access the cloud services from anywhere at any time ((Miller, 2008; Wang et al, 2016).

Rapid elasticity: The cloud technology resource provisioning is happening with a few clicks of mouse and reduces lots of time in infrastructure build. The resource capacity can be easily scaled up or scaled down on demand bases. The resource provisioning can be managed through automatic scripting by reviewing threshold levels without human intervention (Karkonasasi, 2016).

Measured service: Cloud technology provides means for measuring and monitoring utilization trend of resources. The resource level consumption is providing flexibility to cloud providers to charge the consumers for their actual consumption. It also helps consumers to analyse the utilization patterns and decide on budgetary controls. The logging facility also helps for troubleshooting the issues and measuring the uptime against agreed SLA (Marks, 2010; Armbrust, 2010).

On-demand self-service: The cloud provider arranges a self-service portal for demanding their resources. The catalogues of resources and services are made available on the portal. Consumers can pick them up or even customize their requirements (Sultan, 2013). The provisioning can happen in fully automatic ways without human interactions. The cloud data services are provisioned across the globe to provide reliable and high resilience services. The virtualization techniques help to source the required computing unit from large machines (Mell, 2011).

Resource pooling: The multi tenancy feature helps cloud providers to support multiple clients. The hypervisor technology is assisting to host virtual machines from large computing machines. These large computing machines host multiple blades and have the ability to compute smaller portions of computing resources using guest operating systems (OS). These machines hold a high level of redundancy to avoid any single point of failures. Enough measures are taken to maintain individual privacy and data security (Veigas, 2019).

Service Models

Infrastructure as a Service (IaaS):

This is a foundational service model which eliminates the need of purchasing hardware resources such as servers, storage and network infrastructure. You can rent compute capacity from service providers such as virtual machines (VMs), memory, CPU, network and various storage options. Access them remotely and install

required software such as operating system, middleware and build your own application. The underlying infrastructure will be managed by cloud service providers and consumers will be charged for their usages.

Platform as a Service (PaaS):
Under this service model, the service provider is responsible for provisioning of infrastructure as well as the runtime platform which is required to host the application software. The platform runtime includes guest operating system and middleware required to run the application. The consumer has to develop or build their own application over the platform and has its full control. The cloud provider is responsible for upkeep and maintaining high availability of platform services bound by service level agreement (SLA). The required licenses for OS and middleware are managed by cloud providers (Dimitriu, 2015).

Serverless computing is an advancement in cloud technology that brings high levels of redundancy, automatic scaling in and scaling out of resources, increased agility in provisioning, pay as you go billing facility reducing implementation and operational cost. The serverless computing optimizes the server provision and maintenance activities (Gupta, 2013).

Software as a Service (SaaS):
This cloud service provider will deliver end to end offerings. This covers the infrastructure, OS, middleware and application software hosted and managed by cloud providers. The example of SaaS are cloud hosted ERP and office365 packages (Seethamraju, 2014). The consumer pays the licensing fees for usage. The entire product life cycle including patches, fixes and release upgrades are managed by the hosting vendor. The cloud service provider is governed with agreed SLA (Hassan, 2016; Ali, 2017).

Deployment Models
Public cloud: Cloud service provider hosts shared infrastructure with multitenancy at his own premises. This deployment model is less costly than any other cloud deployment model. The infrastructure is shared with other tenants hence likely possibility of security breaches. This deployment model is less recommended for less sensitive data usages. The rapid scaling is the biggest advantage of this model.

Private cloud: This cloud deployment model is entirely hosted for private usages. The infrastructure can be at the supplier side or it can be at the consumer's premises. The ownership and control for the hosting side will remain with supplier due customised business requirements. It is best for data privacy and security and it can be easily tailored for specific industry regulations and compliance. The disadvantages are as it is costlier and requires time and efforts from consumers for its maintainability.

Hybrid cloud: This hybrid cloud deployment model brings the best out of the public and provides a cloud deployment model. The deployment model provides you flexibility to your advantages such as sensitive data can be hosted on private cloud while public cloud can be used for cost saving and rapid hosting purposes. The infrastructure has spread across multiple places bringing redundancy and protecting against complete failure of IT services. The hybrid deployment model can be governed as a single unit and catered for various business requirements following a common compliance and regulatory environment. These need active management.

Community cloud: The community cloud is the fourth deployed model hosted for a group of consumers with common interest. The technology aspect remains for a purpose catering the needs of specific consumer groups. The hosted sites and resources are shared across the group. The decisions are made through collaborative efforts and data accessed within a close community.

Theoretical Framework
SMEs and cloud adoption benefits
SMEs are focused on their own USP and lesser on technology for their IT operations. Every investment they plan in the technology expects to strengthen their organization's presence in the market share. The usages of technology should help them to tab new potential which they are not able to leverage due to limitations such as buying behaviour of consumers and internal turnaround time to cater unpredicted business demands. The companies who have already leveraged IT operations are looking forward to improving their business performance. Both the cases, the objective of organization remains on business agility and increasing profitability (Raut, 2017).

The challenge remains to integrate information technology strategy holistically considering business pain points and produce sustainable business results. The organization needs to develop effective IT strategy which not only attain the business outcomes but also motivated usages of technology across their stakeholders.

Business and IT strategies should be interlocked for producing better business results. Enterprise Architecture (EA) functions assist to transform business strategy into IT strategy using proven methodology, tools, and techniques in the planning functions. Unfortunately, the SMEs do not hold in-house IT experts and they have to rely on external expertise. The earlier research exemplifies that SMEs took help from external consultants, IT experts, and IT suppliers for laying down their IT strategy. External IT experts and IT suppliers are an essential part of the implementation of information technology setup in SMEs (Nguyen, 2022). Sometimes SMEs face issues with external teams as they may or may not understand the SME's specific needs. On other hand, suppliers with a strong technology presence assisting SMEs with their marketing strategies are more cognizant of global issues and their solutions. They will bring aspects of quality, training needs, and maintainability of IT setup and operations. This will inspire SMEs to implement world-class IT solutions to improve their business performance (Budņiks, 2014; Jianwen, 2019).

The responsibilities undertaken by outside IT experts include IT project management, requirement analysis, and blueprint of design, hosting, and provisioning of required hardware and software, and encouraging end users to learn the usage of new systems. These outside consulting organizations or IT experts act as mediators to overcome shortfalls of IT skills in SME and lead to successful implementation and usage of the information technology function.

Cloud Technology has emerged as a trend with its numerous benefits. It is a saviour for small and medium enterprises during the difficult time of the pandemic situation. Cloud adoption is much more than a technology platform. It is critical to develop a value proposition while laying down a cloud adoption strategy (Tan, et al., 2009).

Technology Adoption Models

T-O-E Framework was developed by Tornatzky and Fleischer in 1990 and widely used by researchers. The framework suggests that a business flourishes in harmony with its internal and external environmental needs and strengthens its impact on business outcomes Three key contributing factors were recognized that influence the adoption process i.e. Technology, Organisation, and Environment. It is crucial to consider all these three factors in the decision-making process

The technology context includes platforms made available internally and externally for the smooth execution of the organization. The market conditions are part of the environmental context. The internal leadership support, and internal contextual references such as ways of working fall under organizational context. All the contexts influence technology adoption (Tornatzky and Fleischer 1990).

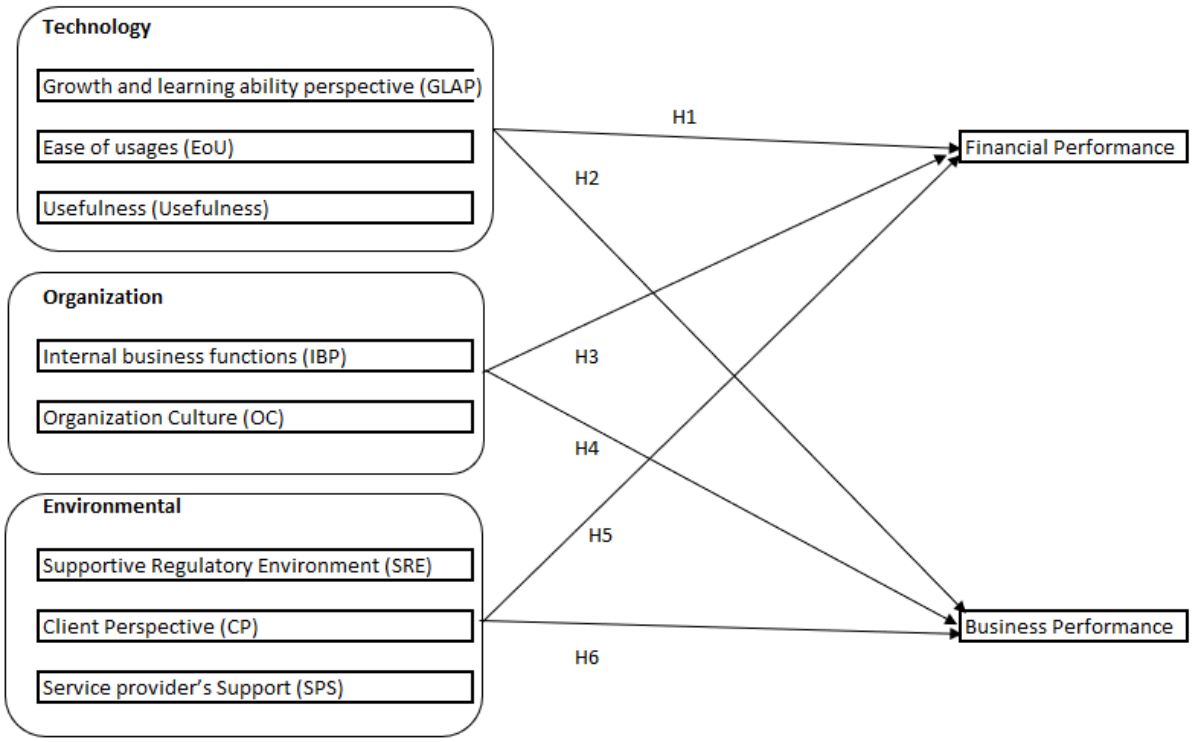

Figure 2: Proposed TOE framework

Based upon the model. Our hypotheses are

H1: Technology is a positive predictive of financial performance
H2: Technology is a Positive predictive of business performance

H3: Organization is a positive predictive of financial performance
H4: Organization is a Positive predictive of business performance

H5: Environment is a positive predictive of financial performance
H6: Environment is a Positive predictive of business performance

Research Design

The second-order structural equation model (SEM) is an analysis tool to obtain descriptive and inferential results. SEM was initially referred to in social sciences as an important statistical technique later various other disciplines such as computer technology started utilizing it as a preferred analytical option (Ringle et al., 2012).

The results are presented using appropriate tabular and graphical representations in the below sections. IBM SPSS.21 has been used to find the results which are outputs of confirmatory factor analysis, path analysis, and Structural Equation Modeling.

The intent of this research is to study the impact of cloud adoption in SMEs belonging to the IT service sector in Pune (India). The survey questionnaires were sent using a google form for data collection to SMEs under information technology sectors in the suburb of Pune city. The questionnaire contains 63 questions divided into three major categories.
The initial part concentrated on the demographic details of responders and their organization.
The second part was focused on the cloud technology usages such as the type of cloud services ingested and its period. The applications accommodate cloud technology and their functions within the organization.

The third and final part covers questions from various constructs discussed under the TOE framework. The 5-point Likert scale is used for measurement. Sample size was determined using sample size determination by mean method.

The 468 samples were used from IT sector SMEs from Pune city. The data was gathered during July 2021 to March 2022. The respondents who are using cloud services were approached using online and offline means belonging to the information technology SMEs.

Assessing the model fit

During Confirmatory Factor Analysis and Structural Equation Modeling (SEM), it is vital to understand model fit results. Also, it is important to know various options in statistical software analysis of moment structures (AMOS).

AMOS is an add-on in the SPSS module and used for confirmatory factor analysis, path analysis and Structural Equation Modeling. The interpretation of model fit parameters with their acceptable ranges from various literature reviews helped to derive fitness of proposed model.

In our study, we referred Five fit indices, Minimum discrepancy as indexed chi-square (CMIN/DF), Comparative fit index (CFI), Goodness of fit index (GFI), Parsimonious Normal fit (PNFI) and Root Mean Square error of approximation (RMSEA) to study the fit between sample data and hypothetical model.

Fit Indices	**Observed Fit**	**Criteria of acceptable fit**	**Results**
CMIN/DF (Minimum discrepancy as indexed chi-square)	4.197	less than 5	Good fit
CFI (Comparative fit index)	0. 882	More than 0.9 for good fit between 0.9 to 0.8 for borderline fit	Borderline fit
GFI (Goodness of fit index)	0. 735	More than 0.9 for good fit between 0.9 to 0.8 for borderline fit	Marginal miss

PNFI (Parsimonious Normal fit)	0. 799	More than 0.5	Good fit
RMSEA (Root Mean Square error of approximation)	0. 083	Less than 0.08 for adequate fit, between 0.08 and less that 0.1 for borderline fit	Good fit

Table 2: Indices Summary

Path		**Std regression weight**	**regression weight (b)**	**S.E.**	**C.R.**	**P**	**Result**
H1	**Technology -> Financial performance**	0.297	0.352	0.083	4.249	***	High sig.
H2	**Technology -> Business performance**	0.33	0.378	0.076	5.001	***	High sig.
H3	**Organization -> Financial performance**	0.468	0.502	0.085	5.896	***	High sig.
H4	**Organization -> Business performance**	0.291	0.301	0.069	4.355	***	High sig.
H5	**Environment -> Financial performance**	0.175	0.193	0.08	2.418	0.016	sig.
H6	**Environment -> Business performance**	0.368	0.391	0.073	5.346	***	High sig.

Table 3: Regression weights and P values (Validating Hypothesis)

SE = standard error
CR = critical ratio
P = probability of committing type I error
Sig. = significance
**** = significant at 0.1% level of significance*

Data Analysis and Discussion

Frequency distribution for variables (Turnover of the company, number of employees and number of years of usages of cloud service model IaaS, PaaS and SaaS)

Variable	**Response option**	**Frequency**	**Percentage**
Turnover in last financial year in Cores (2020-21):	Micro (Upto 5 crore)	141	30.1
	Small (6 to 50 crore)	121	25.9
	Medium (51 to 250 crore)	206	44
	Total	468	100
Human strength of company	1 to 9 employees	46	9.8
	10 to 50 employees	106	22.6

	51 to 250 employees	111	23.7
	250 and more employees	205	43.8
	Total	468	100
How many years your organization is using cloud services [IaaS (Infrastructure as a Service)]	0 to 1 year	172	36.8
	1 to 2 years	30	6.4
	2 to 3 years	83	17.7
	More than 3 years	183	39.1
	Total	468	100
How many years your organization is using cloud services [PaaS (Platform as a Service)]	0 to 1 year	167	35.7
	1 to 2 years	93	19.9
	2 to 3 years	72	15.4
	More than 3 years	136	29.1
	Total	468	100
How many years your organization is using cloud services [SaaS (Software as a Service)]	0 to 1 year	86	18.4
	1 to 2 years	62	13.2
	2 to 3 years	122	26.1
	More than 3 years	198	42.3
	Total	468	100

Table 4: Frequency distribution for Turnover of the company, number of employees and number of years of usages of cloud service model IaaS, PaaS and SaaS.

Reference to demographic details, respondents were asked to choose the Turnover in the last financial year in cores (2020-21). The three options were provided based on SME classification based on turnover. Based on the above details, the majority of the respondents were medium category SMEs, followed by micro and small categories.

Further on demographic details, the respondents were asked to choose the human strength of the company. The four options were provided to choose and they were employees between 1 to 9, employees between 10 to 50, employees between 51 to 250 and employees more than 250.

The majority of the respondents were from the organization whose employees count falls above 250 plus employees, followed by the organization whose employees count falls between 51 to 250 employees and the organization whose employees count falls between 10 to 50 employees.

In continuation to demographic details, the respondents were asked to choose for how many years their organization is using cloud services with respect to the cloud service model. i.e Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS).

For each of the service models, further four options were provided. Those who were using cloud services between 0 to 1 year, 1 to 2 years, 2 to 3 years, and above 3 years.

For Infrastructure as a Service (IaaS), the majority of the respondents were using this cloud offering more than 3 plus years followed by the respondents using the cloud offering between 0 to 1 year and between 2 to 3 years categories.

For Platform as a Service (PaaS), the majority of the respondents were using this cloud offering between 0 to 1 year followed by the respondents using the cloud offering more than 3 years and between 1 to 2 years categories.

For Software as a Service (SaaS), the majority of the respondents were using this cloud offering more than 3 plus years followed by the respondents using the cloud offering between 2 to 3 years and between 0-to-1-year categories.

Conclusion

Post covid pandemic, there is a rise in remote working culture and it is officially adopted by many organizations. Cloud computing technology helps organizations to bring efficiency and capabilities to function remotely (Stieninger, 2018). This does not require significant investments. In today's globalization era, companies are struggling to cope up with fluctuating demands. Sustainment or survival is not possible without the usages of emerging technologies. Cloud technology with its features such as flexibility to scale up, easy to adopt, and cost-effective made it an obvious choice (Armbrust, 2010; Dincă, 2019). Technology is the perfect solution for enterprises' IT needs and helps to attain business objectives.

Due to various service offerings, it becomes difficult to choose the right cloud adoption strategy for SMEs as they lack technical expertise. The approach discussed in the paper will assist them to make the right decision to maximums the returns on investment and maintain a low total cost of ownership (Ghanem, 2021)

Cloud adoption strategy needs to describe the value proposition, adoption of deployment model, suitable service offerings, risk mitigation planning, cost implications, and essential strategic roadmap. The market analysis required to lay down an agile cloud adoption strategy that will remain relevant in the future (Singh, 2023)
Effective cloud adoption requires commitment from the senior leadership team. The disciplined efforts, timely decision making and exception handling through dedicated governance process is required for its success deployment (Karkonasasi, 2016; Weerd, 2016; Dincă, 2019; Nguyen, 2022).

The stronger partnership with cloud service providers and diversified cloud deployment model and service offering will help to mitigate the business risk against failures (Hassan, 2016; Ali, 2017).

The effective cloud strategy should exploit all key benefits of cloud technology such as the pay as you go pricing feature, agility in provisioning infrastructure for just in time use, and on-demand scaling up and down flexibility. This will bring business agility and positive impact on your organizational capabilities to respond to changing market conditions (Kumar, 2017; Ming, 2018; Dincă, 2019; Nguyen, 2022).

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