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Research Article

# Database Management System (DBMS): A Cloud-Enabled Service for Small to Medium Enterprise

[1]Muhammad Nadim, [2]Rana M. Amir Latif, [3]Khalid Hussain, [4]NZ Jhanjhi, [5]Mehedi Masud, [6]Saleh Yahya Alyahyan

## Abstract

Cloud storage is a new IT technology that has created tremendous interest in IT academics and customers. Through linking a vast range of servers across the world through the internet and pooling the services, they generate, cloud storage is a capable invention that is intended to offer tremendous cost savings and exceptional versatility in how companies access the services. In particular, the small and medium-sized companies (SMEs) view cloud infrastructure as a persuasive threat to themselves. Nevertheless, previous studies which examine cloud computing from a business perspective are minimal. Moreover, despite the exponential growth of cloud infrastructure in small and medium-sized businesses, there is no prior study concentrating on SMEs. This research explores the factors that lead specifically for their data to the rapid growth of cloud computing in SMEs. It explores the roles cloud computing played within the Database Management System (DBMS). Owing to the strong prevalence of cloud storage within it, the SMEs are selected, and the homogeneous design of DBMS services. This study allows the SMEs' IT expertise and performs a sample using a systematic questionnaire. The findings showed the term cloud infrastructure applies to several kinds of services. Cloud storage for SMEs is focused on an external (client-oriented) role and an internal (DBMS) function. On the other side, the drawbacks of cloud-based information management systems are restricted mainly to small businesses. This study formulates an important contribution to cloud device science in the field. It should be understood that cloud computing's position is expanding ahead of its technical merits and differs based on market characteristics and company approach. Future experiments are proposed to consider how companies integrate cloud-enabled technologies into their business operation and policy.

***Keywords:*** Database Management System (DBMS), Small and Medium-Sized Companies (SMEs), Cloud, Alpha Reliability Coefficient, Mean, Standard Deviation

[1]Department of Computer Science PMAS-Arid Agriculture University Rawalpindi, Campus
[2]Department of Computer Science, COMSATS University Islamabad, Sahiwal Campus
[3]National Superior Institute of Science and Technology, Islamabad.
[4] School of Computer Science and Engineer, SCE, Taylor's University, Malaysia
[5]Department of Computer Science, College of Computer and Information Technology, Taif University, PO Box. 11099, Taif 21994, Saudi Arabia
[6]Department of Computer Science, Community College in Dwadmi, Shaqra University, Saudi Arabia
E-Mail: muhammadnadim096@gmail.com

# 1 Introduction

Economies are mostly consisting of enterprises, in which SMEs are greater in numbers. SMEs have a vital role in the Gross Domestic Product (GDP) of any country because it contributes more to the business market. Therefore, proposing new approaches or developing new services (DBMS as a service) will be beneficial for SMEs; it will help the SMEs and be very useful and productive for the economy as a whole [1]. The use of suitable Information and Communication Technologies (ICT) can make SMEs more efficient and purposeful in their businesses. Appropriate use of cloud-enabled services can boost the growth and performance in making profits for SMEs. In the cloud computing model, a wide chain of systems is interconnected in private and public networks to provide complex, flexible, and secure information, data, and storage resources [2]. With this technology's breakthrough in computer resource prices, web hosting and remote networking are reducing massive sums. Cloud-enabled applications are realistic ways to achieve immediate cost savings rather than investing significant money on building up a new IT system. One of the strengths is cost dependent as per necessity [3]. Cloud-enabled DBMS is created by interconnecting a vast number of sites called nodes, and a certain networking network interconnects nodes. Node is named database level in this network, and each level has its hardware and software tools. It helps small and medium businesses to build their software as a service application on the network. Online providers may provide SMEs with a range of resources to easily construct their database [4].
In this research, we have proposed an adoption process for cloud-enabled DBMS to fulfill our purpose and categorize its topic and decision. Both customers and service providers can use this paper for better understanding. The research will help SMEs in choosing a suitable cloud computing service.

## 1.1 Cloud Computing Services Models

There are three categories of cloud computing services.

### 1.1.1 Software as a Service (SaaS)

Cloud vendors provide complete software packages remotely as a service as per user requirements. In this service, cloud service providers provide the single instant of the software, and multiple users use it from anywhere remotely. On the client side, they do not need to invest in servers and software licenses and do not care for updating applications. On the other hand, service providers host and manage one application. Google, Amazon and Microsoft Azure are the example of this service [5].

### 1.1.2 Platform as a Service (PaaS)

This framework is essentially more for developers to be given in this simple application creation setting as a base in which customers create high-level infrastructure. The customer can create their program depending on the technology of the vendor. PaaS vendors have predefined alternative solutions for consumers such as LAMP (Linux, Apache, Myself and PHP), Microsoft Design Studio, and Google's Software Engine, etc., to satisfy user expectations, scalability, and manageability criteria [6].

### 1.1.3 Infrastructure as a Service (IaaS)

IaaS offers basic computing resources like storage remotely over the network. It provides shared pool services of servers, storage, networking devices, and data centers and made them available for customers on-demand at a low cost. The client will deploy its software on this service. Amazon, Go Grid, 3 Tera, etc. are an example of IaaS [7].

### 1.1.4 Database as a Service (Dbase)

DaaS provides basic database capabilities to the customers on their needs. The client will connect through the internet and choose their required DBMS for developing, administrating, and managing their data. On the service side, they just need one license for multiple users. The user does not need to worry about backups and upgrading issues [8].

## 1.2 Types of Cloud

There are three types of clouds. Cloud vendors can play a crucial part in choosing the right cloud type for any Enterprise. We have described four deployment model of cloud computing:

- Public Cloud
- Private Cloud
- Hybrid Cloud
- Community Cloud

### 1.2.1 Public Cloud

Public clouds are third-party providers of services; they bring a better economy of scale to customers; the Infrastructure cost is distributed among multiple users, providing low-cost individual customer's needs, it is Pay as you need or Pay as you use a model of cloud computing. Many clients share the same shared pool of services with a minor change in a configuration like security, availability, and cost. All these things are handled and maintained by cloud vendors. The public cloud can be larger than the private and enterprise cloud [9].

### 1.2.2 Private Cloud

There is a private cloud platform for a specific organization/enterprise. Once the full specifications have been fulfilled, suppliers offer a total product to a single company containing all the services necessary. Private clouds are created specifically for one business. They seek to solve data protection issues and provide more flexibility, usually missing in a public cloud. There are two types of private on-premise server corporate server and proprietary cloud privately hosting. External on-site clouds are often named internal clouds and are housed inside the enterprise's data center. Standardized security with minimal scalability is offered in this model [10]. Enterprises would need to spend some of their money on the IT department's physical infrastructure. It is important for systems requiring full networks and network management and configurable. Big companies also utilize this form of clouds. This form of cloud is operated separately by cloud service companies, with maximum protection and privacy protections. For companies who do not

have specialist IT specialists, this form of cloud is a more favored operation. SMEs often use this form of a cloud.

### 1.2.3 Hybrid Cloud

It is a blending of both private and public cloud models. In this type of cloud, the client can enjoy total isolated cloud service with partial sharing, which also increases the variety of cloud computing. Partial sharing of hardware and software resources can be from both clients as well as cloud vendors. This type of cloud is more popular these days due to its variety of services [11].

### 1.2.4 Community Cloud

It is a partnership cloud in which communities of many organizations are involved. Its owner can be a community or some external member. The services providers depend upon the type of service. It is a very good option when forming a partnership. This type of cloud can be established for SMEs, as shown in Figure 1 [12].

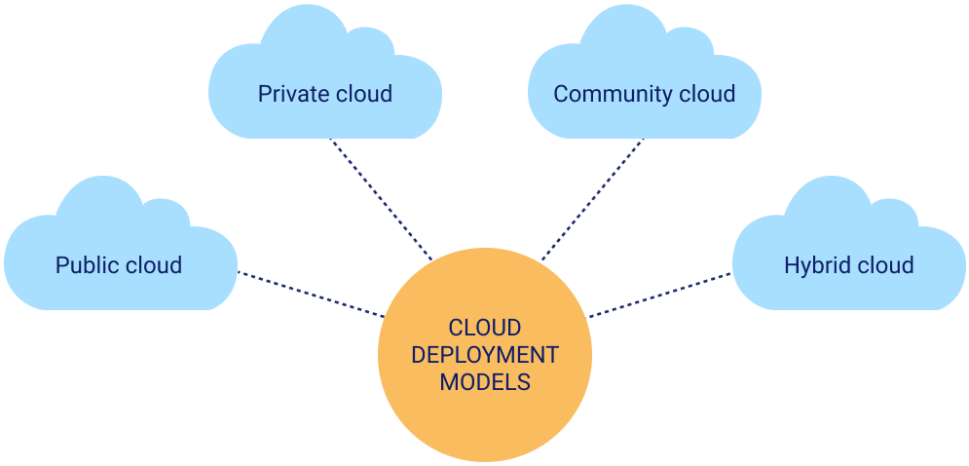


**Figure 1 Deployment Model and Their Characteristics [13]**

## 1.3 Cloud Computing Benefits

Enterprises would require bringing into line their applications to take advantage of the architecture models that cloud vendors provide. Following are some prime benefits of cloud computing services.

### 1.3.1 Low Cost

There are many reasons to feature cloud services with lower costs. Enterprises can pay as you use. Enterprises hire services instead of purchasing; this also saves some capital in the head of maintenance. Its starting expenses are much lesser than establishing a traditional computing department.

### 1.3.2 Variance in Storage

Cloud service providers provide a huge infrastructure of hardware and software. They provide and maintain a huge volume of computing storage. Cloud providers offer elastic storage as per demand which can be increased at low cost without any loss of time and efficiency. Due to its dynamic scaling management, can the cloud handle a rapid workload very efficiently and effectively?

### 1.3.3 Flexibility

It is an exceptionally significant feature. These days, the business condition changes dynamically in the market; therefore, speed and flexibility to deliver very crucially. In rapid cloud adoption, cloud vendors stress bringing service change quickly by using necessary steps for deployment.

### 1.3.4 Availability

The business community is a global village now due to too many innovations in communication bring by information and communication technology. Therefore, data should be highly available every time anywhere. Cloud computing is the best choice because it provides a variety of services remotely 24/7 day, as shown in Figure 2.

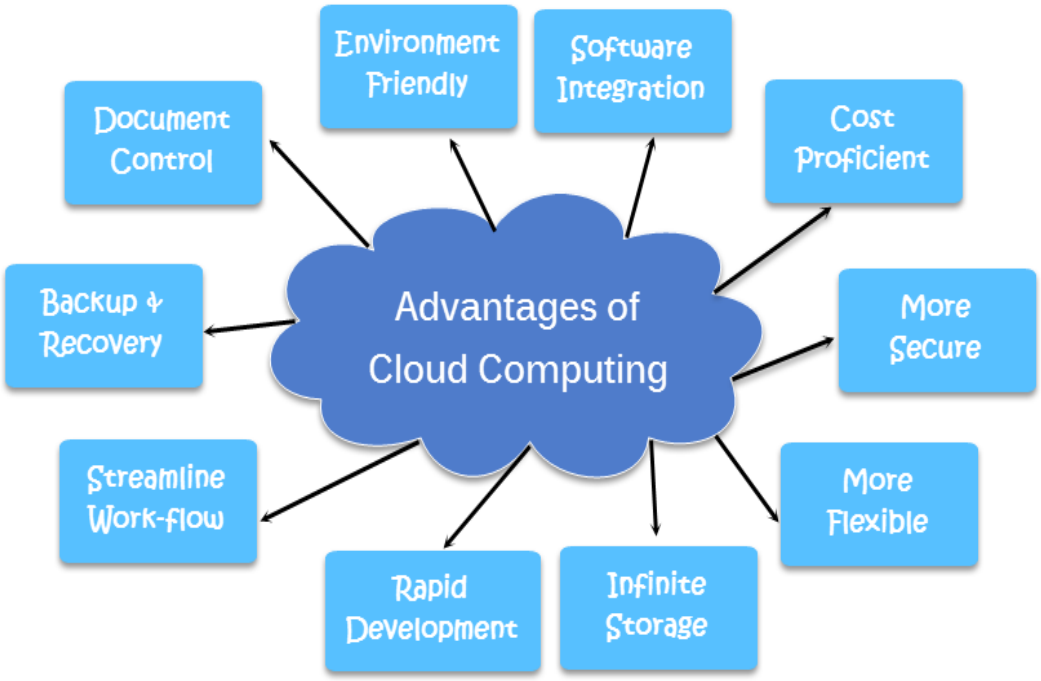


**Figure 2 Cloud Computing Benefits [14]**

## 1.4 Cloud Computing Challenges

Regardless of its rising weight, there are many concerns about cloud adoption. In our view, the advantages offset the disadvantages, and the model is value exploring. Some general face up tube:

### 1.4.1 Data Protection

In remote computing, data protection is still a major concern. Enterprises are unwilling to obtain a confidentiality promise from cloud service providers for business records. They risk contest data following and consumer data protection. The exact data location is not revealed on several occasions, leading to business protection concerns. Any protection barriers around data centers in the current operating models protect the informative knowledge. Maintenance and maintenance are the duty of cloud providers, and businesses have to trust them.

### 1.4.2 Availability and Fault Tolerance

There are service level agreements which customers and cloud vendor strictly follow. Professional teams play the most important role in the managing of agreements and governance of running services. Data recovery, fault recovery, storage management, indexes and logs management, data replication and backup, etc.; if any one of the mentioned services does not service properly by cloud vendors, the losses and impact could be very dangerous for both service vendors and clients.

### 1.4.3 Management Competencies

Even though several cloud vendors, the platform, and infrastructure management are still developing, auto scalability is a prime requirement for many enterprises. Features like "Auto-scaling," for example, is a crucial requirement for many enterprises. There required more improvement in the features mentioned above, as shown in Figure 3.

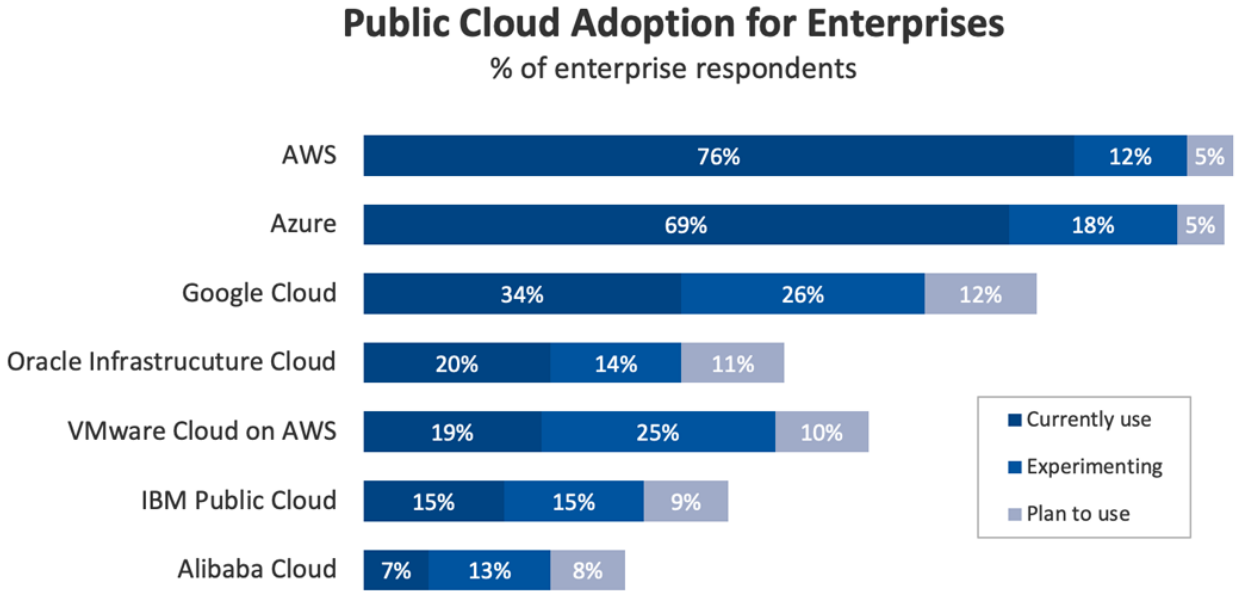


**Figure 3 Right Scale 2020 State of The Cloud Report [15]**

## 1.5 Regulatory Authorities and Restrictions

Cultural and social values vary with the countries. In many countries' personal information of clients and confidential matters, enterprises are not allowed to be disclosed outside of the country

or state. To handle these types of issues, cloud vendors should set their data centers within the jurisdiction area of the respective country or state. It is always not feasible and is a big challenge for service providers.

### 1.6 SMEs And Cloud Computing

According to ICPAK (2013), Smeared is not a public limited company; therefore, they do not have public accountability. SMEs publish their financial statements for their external users or marketing purpose; the company owner does not involve in the day-to-day management. In Europe, their law website defines the micro, small and medium-sized enterprises as follows:
If companies' workers are up to 10, then it micro, up to 50 workers it small and up to 250 employees is an SME. In this scenario, if the company has to establish its own IT infrastructure, it will be a very complex, time-consuming, costly project. It also deviates its concentration from its core business. SMEs have some benefits due to a small number of employees, like fast communication between employees and their executives, and it is easy to implement and execute decisions. But some limitations make SMEs weaker than big companies [16].
SMEs cannot afford to spend a huge amount (relative to their capital investment) on establishing the Information Technology department. Consequently, cloud-enabled services are a better choice for them. Cloud computing is on-demand as demand service at a very feasible cost. It provides many advantages for SMEs like Flexibility, availability, scalability, and cut price. Due to its flexibility and scalability, cloud computing increases the competition between companies. It also allows SMEs to access difficult technologies without spending a considerable amount of money. These benefits allow SMEs to grow larger and become more innovative, productive, and efficient by concentrating more on their core business. It is equally beneficial for both new and existing SMEs [17]. Cloud service providers are specialized industries; therefore, they provide much better infrastructure and services than their own hired IT specialists. Cloud service providers update their hardware and software resources without disturbing the clients. The Cloud computing adoption rate was very high in the global market in 2014. It wares 28%, and it creates 14 million jobs in the world, cloud computing reduces US$ 1.1 trillion a year in new business capitals, and these figures will improve with time.

## 2 Literature Review

Lack of funding is an obstacle for SMEs to incorporate an IT framework to promote more effective business decisions and grow the sector. A service-oriented architecture (SOA) group framework may help SMEs solve this issue. This paper discusses and analyses the models for small and medium-sized enterprises outlined in previous reports. Several issues are listed as the backdrop to the framework implementation. The proposed strategies, including device design, application integration, basic elements, and a model for cooperation, would then be introduced. The study further explores the device design dynamics and partnership operational mechanisms in the studies studied [18].
Multi-tenancy is one of the core aspects of cloud infrastructure. Low faith in leased computing services, however, prohibits consumers from doing the same stuff. This thesis proposes a stable and effective multi-tenant database management framework (SEMTDBMS) for the cloud storage setting to address the research obstacle. SEMT DBMS demonstrates substantial latency and efficiency enhancements over state-of-the-art versions. The research was done based on OLTP

benchmarks, such as TPC-C and Yahoo! Cloud Serving Benchmark (YCSB), with and without compliance with confidentiality [19].

A growing range of major corporations provides cloud storage technology goods and services. Financial organizations are not new to the introduction of cloud computing. FIs now face protection concerns because of the growing amount of data breaches. The task of developing reliable, accessible, and flexible data management systems has challenged the research community of data management and major Internet companies, says the paper. The paper illustrates data processing in cloud systems and implementations for different cloud infrastructure platforms in financial institutions. It also analyzes risk factors in implementing the financial institutions' transaction data on clouds [20].

Information infrastructure connected to the paper development framework with a cloud-based organized storage system and social network feeds. The author integrates updates of social network platforms and resources for calibrating a social network on the same site as the formal database management system and sharing user credentials with the formal database management system. Media updates about knowledge sources for a section of the database accessed in this system development program are used to consolidate social network data updates [20].

SMEs are used as the pillar and driver of both developing and developed economies worldwide. Most organizations use cloud services to outsource their whole Processing operation. It allows reducing high IT maintenance costs without losing commitment to consumer needs. The cloud industry has struggled to expand within small and medium-sized businesses due to many problems during the cloud transformation. The study described cloud prices, availability, interoperability, usability, and other issues related to cloud migration [21].

Emerging technologies and research support the distribution of information in a polymorphic manner that fits a broad spectrum of viewers. The convergence of multiple digital innovations, such as cloud infrastructure, the Internet of Things (IoT), and big data, is the future funding source for developing structures. Currently, IoT, also known as omnipresent sensing, relies on the conventional model. The architecture of IoT includes the extension of the cloud horizon to solve new problems. This article discusses the evolving cloud platforms, useful in IoT paradigms, which enable efficient data processing. We also conceive a new CNNC (Cloud, NNClouda) classification for cloud data types and address various An evolving technology, autonomous vehicle data analytics, is then presented in depth. There were explored problems and guidelines relating to safety, protection, and ethical questions [22].

Cloud-based databases are needed for elasticity and on-demand use for different applications. A cloud-based database can use a shared layer to support distributed query and transaction processing. It can also provide high availability can distributed protocols of consensus. Alibaba's POLARDB served the intense transaction workloads at the 2018 Global Shopping Festival [23].

Cloud computing allows different IT resources to be outsourced to cloud service providers (CSPs). Market and Small-to-Medium Market (SMB) consider this a roadblock in cloud computing since the privacy of the processed cloud data is not strictly regulated. FHE allowed SQL processing is an exciting way to take full advantage of the cloud platform as a service [24].

Businesses are dedicated to collecting and analyzing consumer intelligence. One of their key strategic goals for the next several years is to become a fully data-driven business. They are ready to invest heavily in data and artificial intelligence strategies and develop business technology systems that allow this future vision [25].

During the Big Data age, data was gathered on a scale unparalleled. CEGIS analyses the technology criteria and technological problems in China for Big Data Management. This study

also addresses the product growth possibilities of massive data management in CGIs. It looks at technological developments such as aggregation and preprocessing, storage, and control [3].
The systems and processes enable these apps to be migrated into cloud storage by automating a permanent replication of modifications to the DBMS. For example, DBMS systems and methods enable the migration by several parallel processes [26].
This paper provides a study of the new technologies named "cloud-based computing" or "domain-as-a-service" (DBaaS). It ensures no machine or computer IT requires. Compared to the conventional method of developing an IT environment, computers, devices, licenses are bought, and applications enabled [27].
ICT and deep learning techniques are used to assess the student's sensory focus. The student's concentration score is measured to analyze the students' visual attention. Each picture is transformed to grayscale and improved using image processing, followed by face detection using eye detection [28].
Students can find counseling inside the educational system, although the student-to-counselor ratio is greater. Career therapy may assist students in assessing their careers and determining the right course of action for the future. This chapter aims to investigate, create, and incorporate appropriate methods for evaluating student career therapy, guidelines, and decision-making. The authors created a realistic dataset based on a variety of student mindsets [29].
Emotions are critical in comprehending or assessing a student's level of focus in class. The instructor will determine whether a pupil is engaged in the lesson by reading his emotions. The study examines the impact of information and communication technology universities on their brand image (ICT) [30]. For the successful operation there are several factors which counts well [31-32], including the security, load balancing, memory management, Virtual Machine (VM) effective and efficient use, etc.
The load balancing has a significant role to maintain and manage the operations [33-38] with their right priorities of the job, when and where required.

## 3 Materials and Methods

The main function of this research was to propose the new service of cloud computing for customers as a platform to develop a database at low cost with efficiency. The variables of this research were traditional DBMS and cloud-enabled DBMS in cloud computing. The research methodology for the research is as follow:

### 3.1 Research Design

This thesis dealt with objective data and was persuasive. One questionnaire input has been modified and used in this study. A survey approach was used to gather information and connections between variables such as DBMS allowed by conventional DBMS and Cloud.

### 3.2 Research Questions

The following research questions were formatted for the study:

- What are the features that influence SMEs to adopt cloud-enabled DBMS services?
- What will be the process diagram for adoption?

### 3.3 The population of The Study

The research was carried out to get the information of SMEs using traditional DBMSs and reluctant to shift to cloud-enabled services. Therefore, the research population consisted of SMEs in district Okara and Sahiwal of Punjab province in Pakistan. These SMEs are using DBMS on their hardware and software infrastructures. Following were the grounds for choosing SMEs as the population of the study, as shown in Figure 4:

- Small-sized enterprises are operating in cities that have no proper computing services.
- Some medium-sized Govt and small industries which are operating under some planned computing services

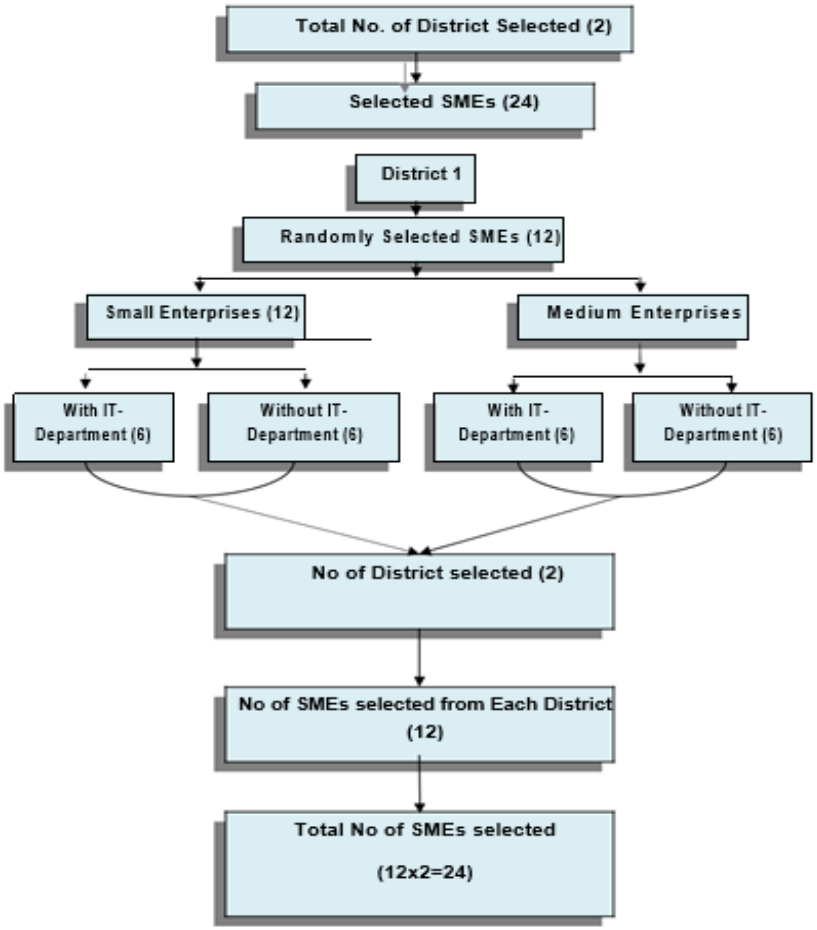


**Figure 4 Selection of Sample for Study**

### 3.4 Sample of The Study

Sampling is a basic component of research. A total of 30 SMEs were selected for sampling from two districts Okara and Sahiwal. We survey with the following strategy: The following steps were adopted for the sample selection:

- Three districts were chosen: Okara and Sahiwal
- Each district was unlikely in two sections based on the business type
- Each stratum was further subdivided into two IT infrastructure pieces
- Many small and medium-sized companies have randomly picked eight SMEs from each segment in Okara and Sahiwal. The study contained all these SMEs. There were 24 (12 from each district) SMEs chosen for the study sample

### 3.5 Distribution of SMEs based on Small & Medium

Table 1 below clarifies the small and medium-sized grouping of SMEs. We take thirty SMEs from two Punjab districts for sampling. Three from each district with existing information technology departments and those without IT departments. The total number of SMEs chosen for the survey is 24. Of these 24 SMEs, 12 were picked from small and 12 from the medium scale. These SMEs are often classified into divisions. We strive to take various market features to analyze and then generalize the findings.

Table 1 Allocation of SMEs based on Small & Medium

| | | | SMEs | | | | |
|---|---|---|---|---|---|---|---|
| Sr. No. | District | SMEs | Small | | Medium | | Total |
| | | | IT | Non-IT | IT | Non-IT | |
| 1 | Okara | 12 | 4 | 4 | 4 | 4 | 12 |
| 2 | Sahiwal | 12 | 4 | 4 | 4 | 4 | 12 |
| Total | | | 8 | 8 | 8 | 8 | 24 |

### 3.6 Research Instruments for The Study

As already stated, the primary objective of the research was to propose DBMS-enabled clouds with requirements except for both vendors and SMEs, and the following information was required:

- Knowledge of Cloud computing for SMEs
- Cloud computing achievements
- Future of Cloud computing

#### 3.6.1 Pilot Testing

The questionnaire was pilot tested in July 2017 on 6 SMEs from Okara and Sahiwal. Three Small-sized enterprises and three medium-sized enterprises were selected. The IT department manager was chosen from the above-listed SMEs to fill out the questionnaire. For pilot studies, Cronbach Alpha Reliability Coefficient approximation was used to assess the reliability coefficient of the questionnaire for analysis. α.831 was found for this rating. The mean, standard deviation, and reliability coefficient values of the pilot test, as shown in Table 2.
The questionnaire was circulated to 87 people. Some of them returned for correction, and after correction, these were again circulated. After receiving the questionnaire, it was put in the SPSS, and an analysis was made on which we have proposed the service. In this questionnaire, we check the quality of service knowledge of the customer and the reliability.

Table 2 Mean, Standard Deviation, and Reliability Coefficient on the Questionnaire for Research

| Mean | Standard Deviation | Alpha Reliability Coefficient |
|---|---|---|
| 42.5908 | 10.0858 | .833 |

After pilot training, the item review was carried out. Dunn-Rankin (1983) defined the object analysis technique as:
"The mean score of each category is an object complexity for the category. The Pearson "r" of an object with a cumulative score of all things (called Object-to-Unit Correlation) serves as an index of prejudice on each component. If the component is strongly associated with the overall ranking, it can be internally aligned and maintained. If a coefficient of association is negative or rather low, it doesn't differentiate between classes and can be discarded.
This report used the parameters mentioned above for item review: the object figures and the Prejudice Score values for analysis. We exclude the query with further variance and variety to render the true piece. We design products with great consideration. Item 2, 3,4,5,8,10,13,14, and 15, based on values, have been rejected and removed from the questionnaire. In the final questionnaire, the remaining 15 elements were kept, as shown in Table 3.

Table 3 Reliability Coefficients for Subscales of Self-Efficiency Questionnaire for Research

| (QFR-A) Subscales | Number of Statements | Alpha Reliability Coefficient |
|---|---|---|
| (QFR-A) Introductory | 8 | 0.561 |
| (QFR-A) Professional | 8 | 0.800 |
| (QFR-A)-Core | 8 | 0.620 |

### 3.6.2 Development of Final Instrument Of SEQ-C

In the final study, we have analyzed the questionnaire composed of 15 elements rather than 24. The 15-point survey was used for data collection from the latest study (DBMS: Appendix A is added to the Cloud-Powered Small and Medium Businesses Information Management Framework for Final Analysis). For the final questionnaire for testing, the alpha reliability value was α 0.93, as shown in Table 4.

Table 4 Item Statistics and Item-Total Correlations

| Item Number | Mean (Difficulty Index) | Item-Total Correlation (Discrimination Index) |
|---|---|---|
| Q 1 | 2.80 | 0.388 |
| Q 2 | 1.27 | -0.069 |
| Q 3 | 1.19 | -0.025 |
| Q 4 | 1.60 | -0.031 |
| Q 5 | 1.78 | -0.033 |
| Q 6 | 2.85 | 0.383 |
| Q 7 | 2.81 | 0.408 |
| Q 8 | 3.31 | -0.058 |
| Q 9 | 2.31 | 0.533 |
| Q 10 | 1.27 | -0.039 |

| | | |
|---|---|---|
| Q 11 | 2.19 | 0.460 |
| Q 12 | 2.51 | 0.395 |
| Q 13 | 3.23 | -0.051 |
| Q 14 | 1.53 | -0.025 |
| Q 15 | 2.31 | -0.653 |
| Q 16 | 2.43 | 0.593 |
| Q 17 | 2.58 | 0.314 |
| Q 18 | 2.91 | 0.395 |
| Q 19 | 2.27 | 0.448 |
| Q 20 | 2.29 | 0.314 |
| Q 21 | 2.31 | 0.365 |
| Q 22 | 2.88 | 0.385 |
| Q 23 | 2.60 | 0.409 |
| Q 24 | 2.97 | 0.393 |

Table 5 below includes the number of queries, the number of queries kept in the final questionnaire, and the reliability values of Alpha in each questionnaire sub-scale for study. Table 6 shows the Final questionnaire elements and reliability coefficients for analysis.

Table 5 Items and the Reliability Coefficients of Final Questionnaire for research

| (QFR-A) Sub-Scales | Number of Items | Serial Number of Statements in the Final Test | Alpha Reliability Coefficient |
|---|---|---|---|
| (QFR-A) Professional | 5 | 9,12,18,21,24 | 0.650 |
| (QFR-A) Professional | 5 | 6,11,17,20,23 | 0.800 |
| (QFR-A) –Core | 5 | 1,7,16,19,22 | 0.787 |

Table 6 Scoring Procedure for Questionnaire for Research (QOR)

| Positive Statements | | Negative Statements | |
|---|---|---|---|
| Category | Scores | Category | Scores |
| Very well | 5 | Very well | 1 |
| Well | 4 | Well | 2 |
| Sometimes | 3 | Sometimes | 3 |
| Not | 2 | Not | 4 |
| Not at all | 1 | Not at all | 5 |

### 3.7 Scoring Procedures

Data from SMEs were obtained using the following methods:

- The study questionnaire (QFR-A) is composed of Liker-style scale sentences. The findings for optimistic and negative questionnaire comments

### 3.8 Data Analysis

After data entry, version 20 of the Statistical Program for Social Sciences (SPSS) was evaluated. The data review was performed under the guidance of Muhammad Rizwan (Assistant Professor), Department of Computers, PMAS Arid Agriculture University, PMAS Barani College, Rawalpindi. The data review began in May 2017 and concluded in August 2017. Cronbach Alpha Reliability Coefficient was used for pilot instrument testing. Similarity Index of difficulties and index of prejudice has also been used to exclude those objects. Statistics informative, i.e., standard deviation and frequency distribution, have been used to explain patterns in results. The Chi-Square values have been used to define the association, and ANOVA has been used to distinguish variations.

### 3.9 Summary

Causal-Compare was the theoretical framework for the current study utilizing quantitative analysis methods. The study community comprises small and medium-sized businesses in Okara and Sahiwal, Punjab province. In the study of 2 districts, 24 SMEs from small and medium-sized businesses were chosen as samples based on their sector. Data were obtained using one tool: Questioner for Analysis (QFR-A). The QFR-A (Research Questioner) has been used to determine the relevance of cloud infrastructure and DBMS. The modified questionnaire for the present research thesis has been pilot-checked and validated.
Data from 24 students were evaluated in the Social Science Statistical Package (SPSS) version 20. For pilot instrument testing, for research purposes. The Alpha Reliability Coefficient of Cronbach has been included. Similarity, to improve the test, is often using the problems index and the bigotry variable. Statistics informative, i.e., standard deviation and frequency distribution, have been used to explain patterns in results. The Chi-Square values have been used to define the association, and ANOVA has been used to distinguish variations.

## 4 Results and Discussion

### 4.1 Cloud-Enabled DBMS Adopting Process

After conducting the survey, we have proposed the above mention adoption model, as shown in Figure 5:

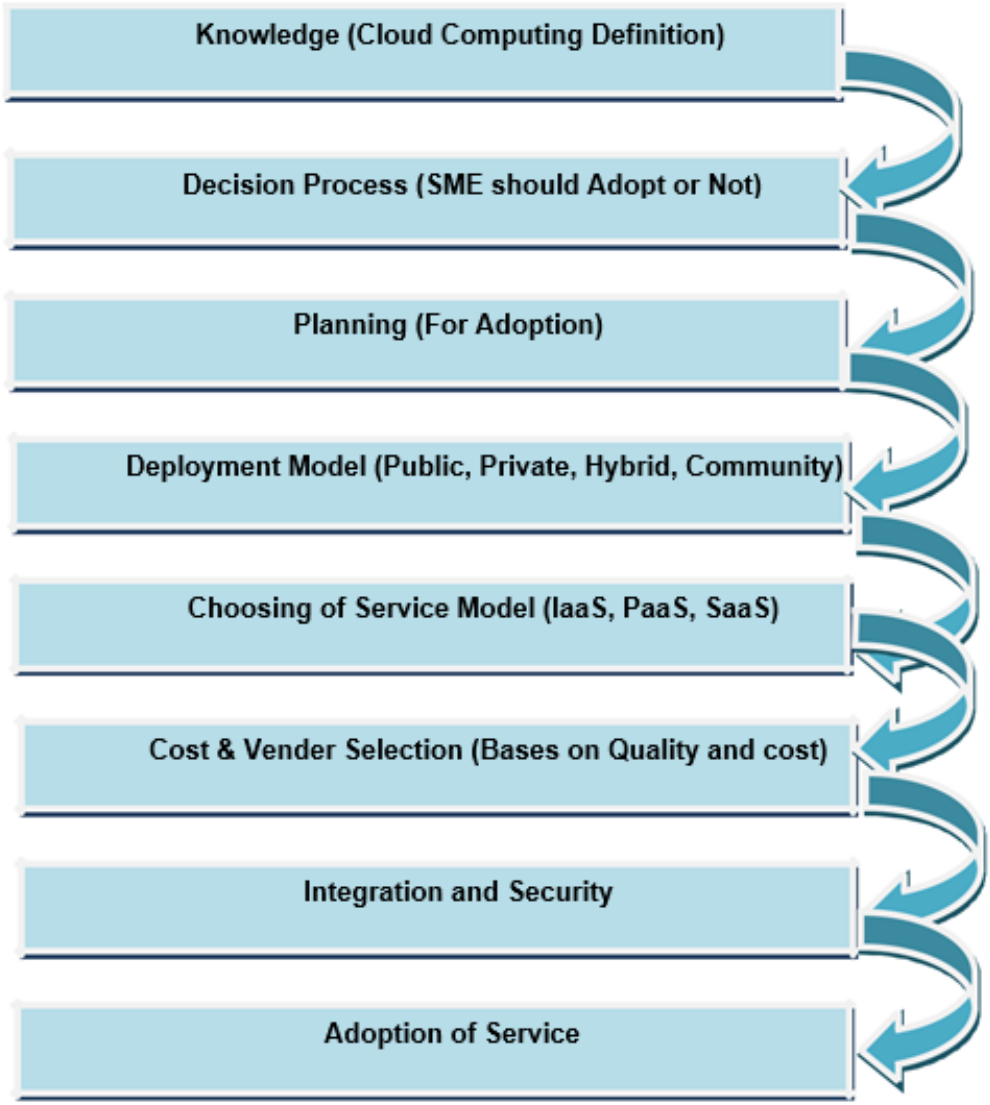


**Figure 5 Adoption Model**

### 4.1.1 Definition of Cloud Computing (Knowledge)

We have observed different views of the customers about cloud computing during this research. User anticipation is not always the same as providers. Service providers always define cloud-enabled services technically and in more depth, but users are always general and overview this technology. It proves a knowledge gap, as cloud service providers have a better understanding which they should have, but users do not have. We try to fill this gap in this research. With no understanding, the customer will not take an interest in this technology. It is not the same for all the customers; some are well aware of cloud computing but still need to motivate them and keep them updated with the evolution of this technology. Service providers should remain in contact with the customers and remain ready to rectify their concerns.

Figure 6 shows the knowledge and understanding of the customer about cloud computing technology. It is very clear from the graph that 10% of the SMEs are unaware of cloud computing,

14% of the organization have some knowledge of this technology but do not know its benefits and disadvantages. Only 48% of the SMEs know cloud computing, its deployment models, types of cloud, its advantages and disadvantages.

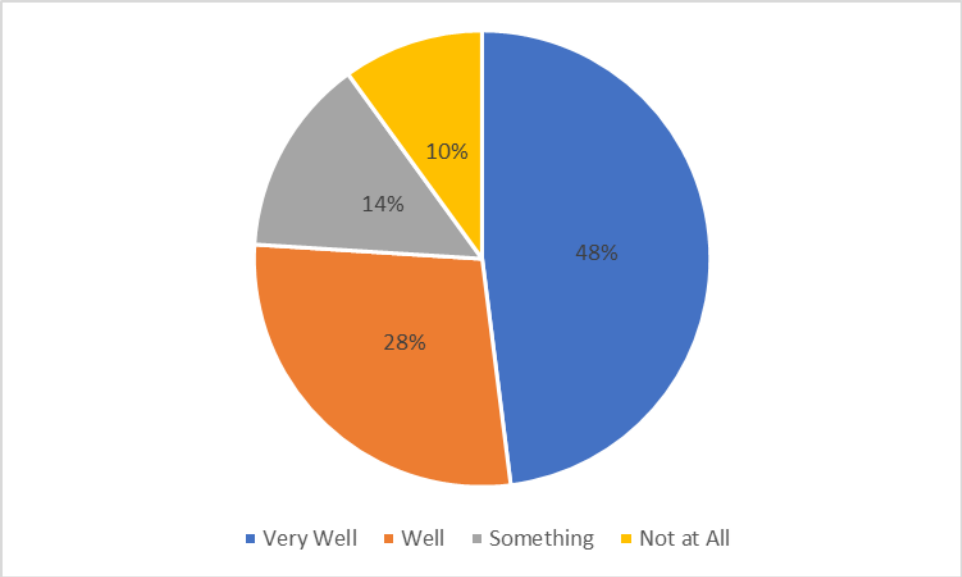


**Figure 6 Knowledge Percentage Graph**

### 4.1.2 Decision Process

The decision process describes the initial steps to implement cloud computing. What are the key benefits of getting cloud-enabled services? Cloud service providers should keep the simple and small implantation process so that customers can easily understand and adopt it. With the evolution of technology, despite waiting too long before getting a decision from the customer but today user gives order and start using services without actual involvement of service providers.
Users can now feel a need to make more sense for adopting a service that is so easy to adopt and maintain as cloud computing. These days,' customers have sufficient knowledge about cloud computing to force them to think about its adoption. The provider just needs to enhance and explore their thoughts positively towards it. Users are always hesitant to deciding between the adoption of new technology, especially SMEs which have low capital and less scope of their business. Providers work to get information transversely to formulate the decision process for customers quicker and easier. Some customer does not worry about the technical aspects of services when deciding that they desire to subcontract. That's why they adopt it without thinking much.

### 4.1.3 Planning

Now SME has decided to shift to cloud computing; the next important stage is planning. In this stage following person should participate

- Company Head (CEO, Manager or representative)
- IT Experts

- Cloud Computing Expert (Could be external)
- Data Manager
- Data Administrator

The people mentioned above will hold a meeting to decide the following things

- Right Deployment Model
- Required Services
- Cost
- Security
- Cloud vendor
- Networking Options & Migration process

The company head is the decision-maker; therefore, he will facilitate the remaining members regarding cost and time. IT experts will explain and answer the question of cloud computing experts and also put up their requirements. The data manager and data administrator will inform the cloud expert about the DBMS they are using and the DBMS they will use in the cloud and tell the expert's volume of data. The network administrator will explain the current networking option, and in the light of this cloud, the expert will explain the required networking options for the service. In the end, the migration process will be decided.

### 4.1.4 Choosing of Right Deployment Model

Choosing the right deployment is the backbone of this model. Each of the four deployment models, every model has its pros and cons. For example, the public cloud model has less cost and utilizes the maximum resources of the company, but it has some security issues. On the other hand, the private cloud model is more cost-effective and has scalability issues. Therefore, we prefer the hybrid cloud model foot this purpose because it has both qualities and has better scalability and availability.

### 4.1.5 Choosing of Right Services Model

After choosing the right deployment model, the next stage is choosing of services model. Our research is on cloud-enabled DBMS; therefore, we need the service to offer a complete application to the end-user. If the company does not have developers, then they have to choose PaaS for this proposal. We can use the Hybrid service with PaaS and SaaS. We strongly recommend the hybrid service for small enterprises.

### 4.1.6 Cost & Vender Selection

Cost is the most effective component in cloud adoption when it involves SMEs because they have less capital than larger enterprises. After observing the tradeoff of both cost and quality of services, SMEs will select the vendor for their company, as shown in Figure 7.

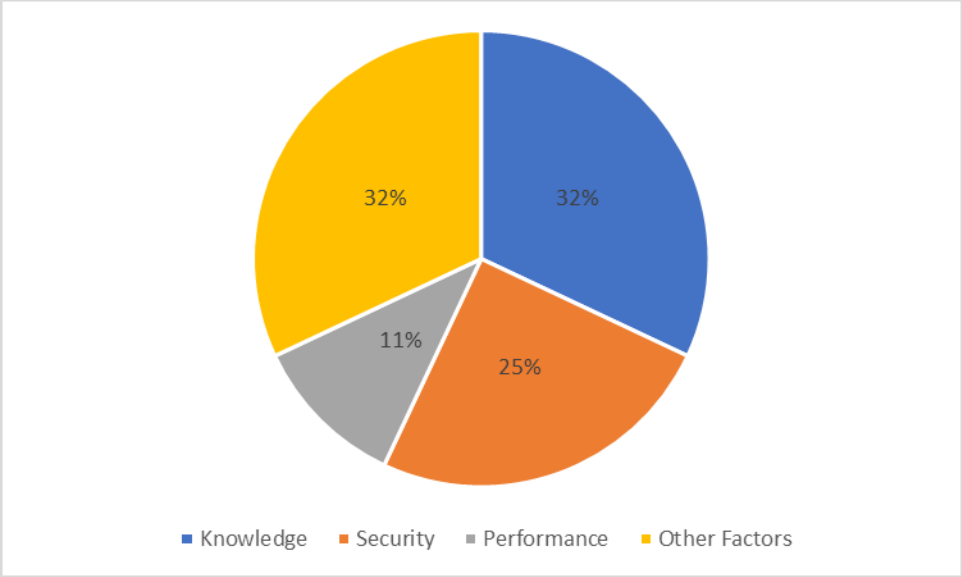


**Figure 7 Cloud Computing Adoption Issues**

### 4.1.7 Integration & Security

The integration is the provider's side issue, not for the customer. The provider works continuously to integrate the existing infrastructure of the users with cloud computing. Integration is an issue, but security is rather a big issue for many users. Data is always an asset for any SME that has an IT department. They are very conscious about their data security; therefore, service providers should explain the shifting process in detail to the customer to remove their concerns about data loss and security. The level of security is increasing day by day.

According to our findings in this research, many users observe that security is a major concern in the adoption of cloud computing. But according to our primary observations, it is the opposite these days. If an SME, which has its own IT infrastructure, wants to shift its IT solution to the cloud. Cloud computing has a better professional IT infrastructure, probably one of the best in information technology because cloud computing runs on technology and professionalism. Clouds have their data centers with the best environment which SMEs cannot provide to their IT department. Its expenses may last beyond their capital. Therefore, a better choice for SMEs to shift their IT solutions to the cloud. Decision-makers of SMEs do not compromise on data security; therefore, service providers have to remain in high communications with them because trust and reputation are assets in the business.

### 4.1.8 Adoption

The adoption in this circumstance is shifting of IT infrastructure to the cloud. It is shifting of business process from one technology to others. Cloud computing is a more effective and cheaper business process. Cloud computing adoption is the possibility to have out-of-house IT infrastructure, or some part of its out-of-the-house is a very good reason for SMEs to adopt it. IT infrastructure has many advantages like maintenance of hardware and software by SMEs themselves out of the house. In the house, IT solutions always expensive and an extra headache for SMEs. By focusing on in-house IT solutions, SMEs can focus more on their core business,

boosting their business. They will feel better themselves for business competitions. Therefore, cloud computing is a very good choice. SMEs do not have to worry about the technical issue of users.

The service provider manages everything, and sometimes the confidence of the provider is questioned because of this. It is safer with the cloud as comported to the in-house IT infrastructure. It is expensive to make in-house IT infrastructure safe and available every time for SMEs. It is a very good balance between cloud service providers and SMEs to make their own business better and innovative. Cloud vendors make their service more effective, updated, cheaper and secure with day-to-day inventions, and SMEs will have full focus on their core business; hence the progress of the fourth side will increase enormously. Another big effect of adoption is software costs SMEs have small capital they cannot make use of costly DBMS like ORACLE etc., but with cloud computing, they can use even better options for this proposal. The distributed environment helps to cut down the cost by shareability. So, cloud computing is a blend of many recent updated technologies, which is very suitable for almost every type of SME.

### 4.1.9 Future Development

SMEs do not have to worry about the upcoming future development regarding IT technologies as their service works. Cloud service providers keep contiguous communications with their customers to keep them update about innovations. SMEs can avail of updated technologies by very little change of expenses without disturbing their business process, which is almost impossible in in-house IT infrastructure. Cloud computing service providers always think about making their service better and bring more in-house setups to their sides. They also try to make strategies to cut down the costs, which alternately beneficial for SMEs. It is very headache for SMEs to shift their IT infrastructure to new technologies. It is time-consuming and costly. It can lead to a big loss of data.

## 4.2 Cloud-Enabled DBMS Adoption Process

The basic idea of this research is to adopt cloud computing and gain a better understanding of cloud adoption. The purpose of collecting data was to explain adopting cloud-enabled DBMS and the purpose behind this decision. Following is the process of cloud-enabled services adoption. That is the purpose of the research, and that will be covered.

### 4.2.1 Primary Stage

In the primary stage, the process is initiated by the SME according to their needs when they realize that cloud-enabled services are the best way to full their needs. It is done by collecting the information about the subject and then acquiring knowledge from it. In the end, they apply their knowledge in this process of adoption. The decision and type of service can vary from company to company depending upon SME size, type of business, capital, and geographic position.

### 4.2.2 Requirement for Adoption

The type of service is important when defining the requirements. It includes security, the scale of service, functioning of cloud, type of DBMS, method of integration, and efficiency of shifting. In

this stage, there needs a healthy dialogue between customers and cloud service providers. Strong documentation regarding terms and conditions and agreement will be prepared to go in the next implementation stage. Cloud service providers will give the solution in the light of customer requirements and define the complete process of shifting. It is the most important stage in adoption. Its basis the implementation. It could include a demonstration of the service being provided.

### 4.2.3 Implementation

The implementation stage is totally on the provider's side. It does not involve the customer much because, in the requirement stage, all the procedure has been defined by the mutual understanding of both sides. Implementation has become easier over the past years. There is no much difference between large and small implementation. This stage does not need much attention because a professional IT expert with full expertise dials it.

### 4.2.4 Maintenance

After the services have been implemented at the user, update and keep system clean maintenance required after a certain period. However, it is also not including customers but is an important stage. Service providers have to look after this stage and notify the customer from time to time according to requirements. Users' attention is not much required in this stage.

## 4.3 Summary

Different concepts of the cloud-enabled DBMS adoption process are discussed in this research. We find a lot of confusion about the understanding of cloud computing; they cannot differentiate between remote computing and cloud computing. Cloud computing has different anticipations in a different mind. It should have to generalize in the minds of people. We try to fill that knowledge gap. We see in the research that this term is not properly defined and focused on by the service providers in the domain of internet services. It keeps hesitant and reluctant the customers to adopt it. Customers do not have proper awareness of it. People have major concerns about adopting this service which we have discussed is security and shifting process. The shifting process, we have explained in detail.

We have been made the decisions behind the adoption of cloud-enabled DBMS and the process involved in adopting this service. We have focused on both user's and providers' perspectives. We used secondary data from past papers and research in this domain and collected primary data through a structured questionnaire. We include both types of questions to investigate the user's point of view and the provider's point of view. The purpose of keeping investigating both sides was to understand the concerns from both sides better. On this basis, we propose the process of adopting cloud-enabled DBMS. With our research and data, we try to answer our research questions. The adoption is very simple in technical terms, and for the customer, it is not as simple as the provider thinks. Cloud-enabled DBMS adoption is a good option for SMEs, and they can save the capital investment of in-house IT infrastructure. It is also a very good way for SMEs to have professional, efficient, scalable, and available DBMS, which works worldwide. Cloud-enabled DBMS is best to alternate in-house/traditional DBMS.

## 5 Conclusion

We have investigated different concepts of the cloud-enabled DBMS adoption process in this research. There is a lot of confusion among the people on the term cloud computing, and they cannot differentiate between remote computing and cloud computing. It has different anticipations and an indifferent mind. It has to generalize in the minds of people. We try to fill that knowledge gap. We see in the research that this term is not properly defined and focused on by the service providers in the domain of internet services. It keeps hesitant and reluctant. The customers to adopt it. Customers do not have proper awareness of it. People have major concerns about adopting this service which we have discussed that is security and shifting process. The shifting process, we have explained in detail.

In this research, we have been made the decisions behind the adoption of cloud-enabled DBMS and the process involved in adopting this service. We have focused on both user's and providers' perspectives. We used secondary data from past papers and research in this domain and collected primary data through a structured questionnaire. We include both types of questions to investigate the user's point of view and the provider's point of view. The purpose of keeping investigating both sides was to understand the concerns from both sides better. On this basis, we propose the process of adopting cloud-enabled DBMS. With our research and data, we try to answer our research questions. The adoption is very simple in technical terms, and for the customer, it is not as simple as the provider thinks. Cloud-enabled DBMS adoption is a good option for SMEs, and they can save the capital investment of in-house IT infrastructure. It is also a very good way for SMEs to have professional, efficient, scalable, and available DBMS which works 24/7 worldwide. Cloud-enabled DBMS is best to alternate in-house/traditional DBMS.

## 6 Future Work

This research has been done on both perspectives' user and service provider. It can be more expanding in future. Cloud computing is still in the evolutionary period, and there is much to learn from cloud computing. It is a new internet-based service in computing. Security and legal issues always there with it. Case research will be more effective for research in this field. One provider with multiple users is one user with multiple offers will be a more interesting topic.

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