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CLOUD COMPUTING ADOPTION FOR CORE COMPETITIVENESS OF SMES IN BEIJING CHINA

SHUO ZHAI [1]* and CHAYANAN KERDPITAK [2]

[1,2] Suan Sunandha Rajabhat University, Thailand.
Email: [1]532977747@qq.com (*Corresponding Author), [2]Chayanan.ke@ssru.ac.th

Abstract

With the intensification of economic globalization and market competition, SMEs (the abbreviation of small and medium-sized enterprises) are playing an important role in the whole world. SMEs are seemed as a vital engine of economic development and growth, job creation and innovation. In many countries, small and medium-sized enterprises occupy the majority of enterprises, and their development is directly related to the stability and sustainable development of the entire economic system. Moreover, the maturity of SMEs is very rapidly because of their features of small size, low operating costs and quickly response. In this situation, the SMEs have to focus on their own core competitiveness to grow up and strongly (Xu, Nickel, Machado, & Hajiyev, 2015). However, at practical level, there are many difficulties and barriers preventing their development and growth. For example, they often face limited resources, difficulties in financing, fierce market competition, and inadequate management capacity. The existence of these problems leads the SMEs can only concentrate on how to survive in the complex and dangerous market environment, but ignore improve their core competitiveness, which limits their competitiveness and sustainable development ability in the market. Basing on years of research and observation suggest, cloud computing services have obvious effect on reduce cost and manpower (Furht and Escalante, 2010). Many researches and practices has proved that cloud computing can solve the problems of SMEs. And recently studies shows that SMEs are more appropriate to use cloud computing for seeking low cost and high efficiency than other firms (Bello et al., 2021).

Keywords: SME, Core Competitiveness, Cloud Computing Adoption, Technology, Organization.

1. INTRODUCTION

1.1 Problem Statement

The advantages of SMEs are obviously and significant, they are more efficient and flexible than other large enterprises. If they concentrate on developing their core competitiveness, they may grow up and stand out quickly. But on the other hand, the weaknesses of them are also very mortal. The small size and poor experience, letting them possibly disappear or be swallowed at any time. Thus, it really important for SMEs to seek external help to avoid them weakness, absorbing their core competitiveness. So, to research what is the core competitiveness of SMEs, how to improve them, and which factors will affect them are very important and urgent. And our research is very vital and has practical guiding significance.

There are large amount of researches and studies shows the advantages of cloud computing for SMEs to support our research. But, science and technology are constantly evolving and changing, so the cloud computing and SMEs are. Thus, we have to conduct more precise and profound study to let our research more useful and reasonable. In addition, for seeking more detail and relationships, we will pay attention to the cloud computing adoption and core competitiveness of SMEs.

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1.2 Research Questions

According to the relevant research all over the world, our research aims to build a theory model of core competitiveness of SMEs. Then, using this model to explore the core competitiveness of SMEs and its influence factors, and research the following problems.

(1) What are the factors that affect core competitiveness of SMEs?

(2) What are the factors that affect cloud-computing adoption of SMEs?

(3) How to measure the core competitiveness of SMEs based on the influence factors.

(4) How to improve the core competitiveness of SMEs.

1.3 Research Objectives

According to the above, the following research objectives of our paper are show below:

(1) To investigate technology, organization, environment, cloud computing adoption, and core competitiveness of SMEs in Beijing.

(2) To investigate influencing factors of core competitiveness of SMEs in Beijing.

1.4 Research Hypothesis

H1: Technology has a positive direct effect on cloud computing adoption.

H2: Organization has a positive direct effect on cloud computing adoption.

H3: Environment has a positive direct effect on cloud computing adoption.

H4: Cloud computing adoption has a positive direct effect on core competitiveness of SMEs.

1.5 Scope of the Research

1.5.1 Scope of Content

Our research will use both qualitative and quantitative analysis through precise questionnaires survey, and arrive at a conclusion according to our research objectivity. The scope of our research mainly in Beijing, China lasting 3 month from October to December 2023 by both online and offline questionnaires. Our study mainly revolves around cloud computing and SMEs, Beijing is the capital of China with high-level modern technology and large amount of SMEs, which provide us an excellent research scale and environment. At the same time, I grow up and live in Beijing. Thus, Beijing of China is the best object for our study.

1.5.2 Scope of Population and Sample Size

Population

Our research will study the SMEs in Beijing, and we will use the the SRDI SMEs in Beijing as our population, the number of our population is 2198. SRDI means: Specialized, Refinement, Differential and Innovation, SRDI SMEs have more obviously characteristics of SMEs, they are much more representative of the SME, they are more suitable to conduct our research. Our research will focus on the core competitiveness of SMEs in Beijing, so we have to conduct the research according to the SMEs in Beijing.

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Sample Size

Based on the reflection and summary of research design and practical application, scholars generally believe that the sample size should be more than 20 times the dimension (Brown, 2012; Johnson, 2015). In our research, we have 14 dimensions.

So the sample size of our quantitative research is the 280 SMEs from 2198 SRDI SMEs in 16 districts of Beijing. Thus, we need to hand out 280 valid questionnaires to conduct the survey.

1.5.3 Scope of Variable

Our research set up a theoretical model and framework according to TOE Theoretical Framework and Resource Dependence Theory.

Technology, organization and environment are the independent variables; cloud-computing adoption is the mediating variable linking technology, organization, environment and dependent variable core competitiveness.

1.5.4 Scope of Time

May 2023- June 2024

1.6 Significance of the Research

It is of great research value and importance to study the effect of cloud computing on the core competitiveness of SMEs. Through in-depth research in this field, it can provide targeted development suggestions for SMEs and promote the sustainable development of SMEs in global competition.

Besides, it is of great theoretical and practical value to study the influence of cloud computing on the core competitiveness of SMEs and its political significance. This study will provide guidance for the development of SMEs, provide decision-making basis for the government to formulate relevant policies.

1.7 Expected Outcome

After learning our research, the SMEs, who have difficulties and obstacles to enhance their core competitiveness, may get help and new ideas about their growth and development.

(1) The SMEs will clear about the core competitiveness of themselves and how to use core-competitiveness for better development.

(2) The SMEs will have the knowledge about the features and benefits of cloud computing and how to improve their core competitiveness by using cloud computing.

(3) The cloud-computing supplier will learn the factors that affect them adoption.

(4) The cloud-computing supplier and designer will have a more profound comprehension about SMEs and other enterprises for offering better services.

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2. LITERATURE REVIEW

2.1 Theory

2.1.1 Technology-Organization-Environment Theoretical Framework

Technology-Organization- Environment theoretical framework, the abbreviation is TOE framework, was first published by Louis G. Tornatzky and Mitchell Fleischer in 1990.It is a theoretical framework to present the decision of a business or enterprise accepting a technology (Awa and Ojiabo, 2016). And the influence factors of the this technology adoption from 3 angles, they are technology, organization and environment. The figure of TOE framework will show below.

Our research will talk about the influence of cloud computing for SMEs core competitiveness. So the first step is to research the factors which will affect SMEs to accept cloud computing. SMEs are special enterprises, and cloud computing is an innovation technology, its suitable to use TOE framework to do our research. Thus, we choose TOE theoretical framework to explore and explain the influence factors and relationship between technology, organization, environment and cloud computing adoption (Gangwar, Date, & Ramaswamy, 2015). The TOE theoretical framework shows that Technology, Organization and Environment are all affect the Cloud Computing Adoption (Al Hadwer, Tavana, Gillis, & Rezania, 2021). And we can get a part of framework below.

2.1.2 Resource Dependence Theory

Resource Dependence Theory, the abbreviation is RDT. RDT is a theory about how the external resources of an organization affect the behavior of the organization. It proposed that every organization or firm has to use external resources to improve them behavior and strength them competence. It is first proposed in 1970s from the publication of The External Control of Organizations: A Resource Dependence Perspective from Pfeffer and Salancik in 1978.

Our research talks about the SMEs strength them core competitiveness by adopting cloud computing technology.The resource dependence theory(RDT) explains how an organization improve them performance and competitiveness by the help with external resource. For SMEs, cloud computing is an innovation method with low cost and high efficiency, it can be seen as an external resource, using cloud computing can make SMEs more efficient and flexible without high cost and maturity equipment, and can have more attention on their core competitiveness improvement. So, we use RDT to show the relationship that cloud computing adoption will influence the core competitiveness, and the relationship shows below. It shows that The Cloud Computing Adoption affects The Core Competitiveness (Davis & Cobb, 2010) .

2.2 SME

SMEs, the abbreviation of small and medium enterprises, which have smaller scale, fewer manpower and capital (Gerald l, Susman, 2007). The criterion of SMEs is different and often changing in different time and situation (OECD, European Training Foundation, European Union, European Bank for Reconstruction and Development, 2015). There are huge difference in criterion of SMEs, different country have different criterion, different industry also has its

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standard, even different field has their own method to separate SMEs. Some choose personnel to define, but some use whole assets to distinguish (Nwankwo and Gbadamosi, 2010). Below is a table to show the different standards of different countries and different industries.

Our research will focus on the core competitiveness of SMEs in Beijing, so we have to conduct the research according to the SMEs in Beijing. According to the data from Beijing Municipal Bureau of Economy and Information Technology statistics: there are 2198 SMEs in Beijing rated as SRDI in nearly one year. SRDI means: specialized, Refinement, Differential and Innovation.

2.3 Cloud Computing

Cloud computing is a model which can offer needed network into a shared pool of configurable computing resource (e.g., networks, servers, storage, applications, and services) (Blessy & Kushwaha, 2023), which can be speedily configuration provided by fewest management and commutation (Ma, Zongmin, 2016).

According to Carr (2005), it is a good method to use advanced technology for SMEs, such as cloud computing. After that, Rittinghouse and Ransome (2009) explained the reason that SMEs should use cloud services is assets. Besides the study of Gorniak (2009) shows the reasons of cost, efficiency and security are why cloud computing can offer help to SMEs. Surendro & Fardani (2010) said that SaaS of cloud services is more fit for SMEs. At the same year, Lawrence et al. (2010) and Misra and Mondal (2010) hold, cloud computing is the better tools for SMEs comparing with bigger firm. What is more, basing on the study of Handler et al. (2012) and Rahimili (2013), cloud computing can offer different service and mode to reach the demand of users. However, Reimer et al (2015) says that the SMEs have to pay attention on the security issues when using cloud computing.

2.4 Technology

It is the application of knowledge for achieving practical goals in a reproducible way. It can also means the products resulting from such efforts: including both tangible tools such as utensils or machines, and intangible ones such as software.

By induction and summary, we selected the 3 most used and mentioned dimensions from others as our dimensions of Technology, they are:Relative Advantage, Compatibility, Complexity.

2.5 Organization

In the broad sense, an organization is a system in which many elements are connected to each other in a certain way.

In a narrow sense, organization is a collective or group formed by people to achieve certain goals, such as enterprises, military organizations, and so on.

The narrow sense of organization refers specifically to the population, which is used in social management. In modern social life, organization is a social group organized by people according to certain goals, tasks and forms.

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Organization is not only the cell of society, the basic unit of society, but also the foundation of society.

From the perspective of management, an organization is a social entity that has a clear goal orientation, a well-designed structure and a consciously coordinated system of activities, while maintaining a close relationship with the external environment.

By induction and summary,we selected the 3 most used and mentioned dimensions from others as our dimensions of Organization, they are: Top Management Support, Organizational Readiness, and Organization size.

2.6 Environment

It refers to a system composed of various factors that are interdependent, mutually restrictive and constantly changing, and is a collection of realistic factors that affect enterprise management decisions and production and business activities.

This definition does not refer to the external environment of the enterprise, nor does it refer to the internal environment of the enterprise or some aspects of the internal environment, but refers to an environmental system.

The enterprise environment consists of two parts: external environment and internal environment.

The external environment of the enterprise is composed of variables that exist outside the organization and are usually not controlled by the top management in the short term.

The internal environment of an enterprise is composed of the variables that exist in the organization and are usually not controlled by the top management in the short term, including the organizational structure, culture and resources of the enterprise.

By induction and summary,we selected the 2 most used and mentioned dimensions from others as our dimensions of Environment, they are: Competitive Pressure and Government support.

2.7 Cloud Computing Adoption

It refers to an enterprise or organization's adopt cloud computing technology to achieve the functions of cost reduction, risk mitigation and database scalability.

It is an innovation and efficient strategy for companies or organizations.

By induction and summary,we selected the 3 most used and mentioned dimensions from others as our dimensions of Cloud Computing Adoption, they are: Cost, Service, Security

2.8 Core Competitiveness

The resources and capabilities that comprise the strategic advantages of a business, which cannot be easily imitated and substituted.

It refers to the resources for enterprises that can bring comparative competitive advantages, allocation and integration of resources. By induction and summary,we selected the 3 most used and mentioned dimensions from others as our dimensions of Core Competitiveness, they are: Efficiency, Flexibility and Innovation.

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2.9 Conceptual Framework

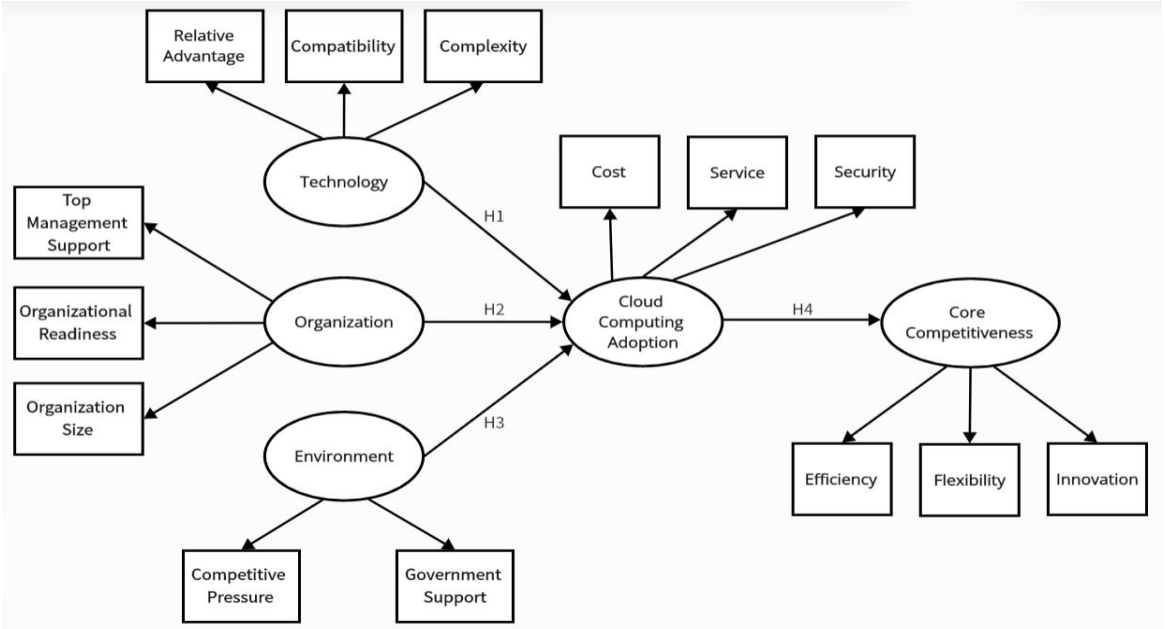

Figure 1: Conceptual Framework

Table 1: Summary of Variables

Variable	Dimension	Hypothesis	Theory
Technology	Relative Advantage	H1: Technology has a positive direct effect on cloud computing adoption.	Technology-Organization-Environment Theoretical Framework
	Compatibility		
	Complexity		
Organization	Top Management Support	H2: Organization has a positive direct effect on cloud computing adoption.	
	Organizational Readiness		
	Organization Size		
Environment	Competitive Pressure	H3: Environment has a positive direct effect on cloud computing adoption.	
	Government Support		
Cloud Computing Adoption	Cost	H4: Cloud computing adoption has a positive direct effect on core	Resource Dependence Theory
	Service		
	Security		
Core Competitiveness	Efficiency		
	Flexibility		
	Innovation		

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The Table above shows the information about variables, dimensions, hypothesis and theories used that summarized from literature review. And form the research and literature review, our conceptual framework coming up below.

3. RESEARCH METHODOLOGY

3.1 Research Design

Our research is a mix-method research including both quantitative research and qualitative research. Using these research method to explore the influence factors and their relationship of core competitiveness of SMEs. The mix-method research combines quantitative research methods (such as questionnaires, statistical analysis, etc.) and qualitative research methods (such as interviews, observations, literature analysis, etc). Quantitative research can provide data support and statistical analysis, while qualitative research can provide in-depth understanding of phenomena and problems. By combining these two methods, more comprehensive research results can be obtained.

Our research will explore the core competitiveness of SMEs in Beijing, Beijing has a large number of SMEs about 1.66 million. According to the data from Beijing Municipal Bureau of Economy and Information Technology statistics: there are 2198 SMEs in Beijing rated as SRDI in nearly one year. SRDI means: Specialized, Refinement, Differential and Innovation. These 2198 SRDI SMEs are more representative and convincing for our study. Thus, we choose these 2198 SRDI SMEs as our research population. We will use mix-method research, questionnaires as the tool of quantitative research and in-depth interview as the tool of qualitative research. Beijing has 16 districts, we will use stratified sampling to select 280 managers and leaderships of SMEs in Beijing from 16 districts as the sample size of quantitative research and use simple random sampling to choose15 of them as the sample size of qualitative research.

3.2 Quantitative Research

3.2.1 Population and Sampling

Population： Our research will study the SMEs in Beijing, and we will use the the SRDI SMEs in Beijing as our population, the number of our population is 2198.

Sampling： we will use stratified sampling to do our quantitative research.

(1) Divide the SMEs into 16 groups according to the 16 districts of Beijing.

(2) Acquire the amount of SMEs in each district of Beijing.

(3) Calculate the percentage of the SMEs of each district in Beijing.

(4) Extract the SMEs basing on the each percentage of each district.

3.2.2 Test of Instrument

The tools of quantitative research is the questionnaires. In our research, we have 5 variables and 14 dimensions, according to these, we design a 5-point Likert scale with 70 items for scoring.In our 5-point Likert scale, we design 5 questions for each dimensions of each variables, and using

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1-5 score to estimate the degree of agreement with the sentences. In the Likert scale,

1=Strongly Disagree,

2=Disagree,

3=Uncertain,

4=Agree,

5=Strongly Agree.

(1) Reliability Analysis

Before we hand out our questionnaires, we first invite 30 interviewees to conduct pre-research to test whether our questionnaire was reasonable and effective. We will make a reliability analysis from pre-research by Cronbach's alpha reliability coefficient method.

(2) Validity Analysis

We will invite 7 experts from different fields to score our questionnaire. And using the Item Objective Congruence(IOC) to do the validity analysis. After the feedback and modification from experts, the average IOC score has been guaranteed to be greater than the general standard.

3.2.3 Confirmatory Factor Analysis

After data collection, we have to analyze the data, we will use SPSS to analyze data, and then establish the structure equation model(SEM) by using AMOS software to validate our research hypothesis.

3.3 Qualitative Research

3.3.1 Population and Sampling

Population： The population of our qualitative research is the same with our quantitative research; it is the 2198 SMEs of 16 districts in Beijing.

Sampling： Conducting in-depth interviews in qualitative research, usually with the number of interviews between 10 and 15 people. This range can provide enough interviews to gain deep insight and understanding, but not so much that data analysis becomes overly complicated or time-consuming. Thus, our research will use simple random sampling to select 15 managers or leaderships of these 2198 SMEs to do the in-depth interview for our qualitative research, so the sample size of qualitative research is the 15 SMEs from 2198 SRDI SMEs in 16 districts of Beijing.

3.3.2 Measurement

We will use the interview outline as our qualitative research tool. Our interview is the semi-structured interview.In the outline, there are 8 questions. Through these 8 questions to discuss the relationship of variables, explain and supplemental illustrate the quantitative research findings.

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3.3.3 Data Collection

The tools of our qualitative research is the outline of in-depth interview. After outline design, we invite relative experts to review and check whether our outline is reasonable and effective. After being recognized, we will conduct the in-depth interview. We will interview 15 managers or leaderships of SMEs in October in Beijing. We will send out the outline to the interviewees, the interviewees will write down the answer on the outline. Then, after finish answering, we collect the interview outline. Each in-depth interview will take approximately 30 minutes to complete.

3.3.4 Data Analysis

We will analyze the data from in-depth interview by N-VIVO to acquire the research conclusion. We will use the N-VIVO to do the tertiary encoding, and describe each level of coding by examples. Through word frequency and correlation analysis acquiring the qualitative conclusions which consistent with the quantitative findings.

4. DATA ANALYSIS，RESULTS AND FINDINGS

4.1 Quantitative Analysis

The 4 research hypotheses of the study have shown significant results through data analysis. Through literature review, it is found that science and technology have a significant impact on cloud computing adoption, which is consistent with the analysis and research on the significant impact of science and technology on cloud computing adoption proposed in "Cloud Computing and Scientific and Technological Development". (Zeng et al. 2021); Organizations have a significant impact on cloud computing adoption, similar to The NIST definition of cloud computing (Mel et al., 2011), The viewpoint proposed in Cloud computing: implementation, management (Rittinghouse et al., 2016) is consistent. The environment has a significant impact on the adoption of cloud computing.

The viewpoint presented in the NIST definition of cloud computing (Mel et al., 2011) is consistent. The adoption of cloud computing has a significant impact on core competitiveness, which is related to The second machine age: Work, progress, and expertise in a time of brilliant technologies (Brynjolfsson, 2014), What's your digital business model? (Weill, 2018) The viewpoints presented in are consistent. The adoption of cloud computing has a significant mediating effect between technology and core competitiveness. They believe that cloud computing technology can make companies more flexible, reduce IT costs, improve resource utilization, and gain an advantage in market competition, thereby affecting the formation and enhancement of core competitiveness. This is consistent with the results of this study. The adoption of cloud computing has a significant mediating effect between organizational structure and core competitiveness. The study on the impact of cloud computing on enterprise organizational structure and core competitiveness explores the impact of cloud computing on enterprise organizational structure and core competitiveness, and points out that cloud computing technology can act as an intermediary to promote the flexibility of organizational structure and the improvement of core competitiveness, which is consistent with the viewpoint put forward by

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the actor. The adoption of cloud computing has a significant mediating effect between the environment and core competitiveness, and the retail enterprise core in the Internet environment.

4.2 Qualitative Analysis

By sorting out the relationships between these concepts and concepts, as well as between categories, it can be found that these four dimensions are interrelated and together constitute the impact model of the core competitiveness of small and medium-sized enterprises, as shown in Figure 1.

5. CONCLUSION

This study adopts a mixed research approach that combines quantitative and qualitative research. Through the analysis of quantitative data, the model was fitted and tested. Through in-depth interviews and three-level coding of interview outlines, consistent results were obtained from both quantitative and qualitative studies. The adoption of cloud computing has a significant impact on the improvement of the core competitiveness of small and medium-sized enterprises. Technology, government, and organizations have a significant impact on cloud computing, and the adoption of this intermediary variable through cloud computing has a significant impact on core competitiveness.

5.1 Research Conclusion

Through research, we have come to the following conclusion that cloud computing has become one of the important tools for small and medium-sized enterprises to improve operational efficiency, reduce costs, and enhance competitiveness. Cloud computing is an internet-based computing model. By outsourcing data storage and processing tasks to remote servers and applications, it can achieve resource sharing, elastic expansion, flexibility and other advantages. For small and medium-sized enterprises, cloud computing can reduce IT costs, improve flexibility, enhance security, and support rapid business development.

5.2 Research Findings

This study revolves around two predetermined research objectives, the first of which is to invest in technology, organization, environment, cloud computing adoption, and core competitiveness of SMEs in Beijing. Through the study, we found that small and medium-sized enterprises, as an important component of the economy, play an important role in economic and social development. Faced with an increasingly competitive market environment, small and medium-sized enterprises need to continuously enhance their core competitiveness in order to maintain their competitive advantage. In today's digital age, cloud computing, as a powerful technological tool, provides opportunities for small and medium-sized enterprises to achieve efficiency, flexibility, and innovation.

Cloud computing, as an advanced information technology, provides powerful data storage and processing capabilities for small and medium-sized enterprises. Through cloud computing, small and medium-sized enterprises can achieve resource sharing, flexible expansion, and cost savings, thereby improving their production efficiency and service quality. Therefore, the adoption of

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cloud computing has a significant impact on the core competitiveness of small and medium-sized enterprises. In order to better utilize cloud computing to enhance core competitiveness, small and medium-sized enterprises need to pay attention to three factors: technology, organization, and environment.

5.3 Research Discussion

Small and medium-sized enterprises face many controversies and challenges when adopting cloud computing, including security, cost, data privacy protection, and service reliability. However, by selecting suitable cloud computing service providers, strengthening internal security management, and signing detailed service level agreements, small and medium-sized enterprises can effectively address these disputes and challenges, achieve effective utilization of cloud computing technology, and promote the sustainable development of enterprises.

5.4 Next Step Research

This study proposes the impact of cloud computing adoption on enhancing the core competitiveness of small and medium-sized enterprises from three aspects. The study suggests that the next step should focus on the following aspects. Further research on the application of cloud computing technology in small and medium-sized enterprises can explore the following aspects: studying how to strengthen the security of cloud computing environments in small and medium-sized enterprises, including technologies such as data encryption, access control, identity verification, as well as policies and mechanisms for privacy protect.

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