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CLOUD COMPUTING SOLUTIONS FOR SPEEDING-UP THE SMALL-AND MEDIUM SIZED ENTERPRISE (SME'S) BUSINESSES IN CHINA

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ABSTRACT

China has experienced rapid digitalization in the last decade. Cloud computing makes possible for different users to access data resources from any geographical location through the Internet. This new paradigm has the ability to benefit businesses by offering low-cost, flexible, and customizable solutions that provide companies significant competitive advantages in the strongly competitive business environment on long-term timescale. It can be essential for all business, but it is especially indispensable for small and medium-sized enterprises (SME's) to make prosperity in today's accelerating social, economic and technological changes. In recent years, the SME's have allocated more budget to invest in implementing digitization and data-based decision making processes as they have become more aware of the importance of technological development and managing information on boosting their competitiveness in values creation activities. However, they are restricted by the size of the business. Transformation of information construction and digitization process is still in its infant stage as a consequence of a shortage in experts and available resources. This situation has gradually changed with the advent of cloud computing technology. By leveraging cloud computing technology, SME's could completely support the digital transformation process in an efficient and effective manner. Nevertheless, for those business organisations who make efforts for application of any cloud computing solution in their business processes, they have to face with some serious emerging questions. Whether the business deployed on the cloud provided by service providers has sufficient system robustness, and whether the data stored in the cloud has sufficient security. This review paper is aiming to provide comprehensive, relevant landscape about the different cloud computing solutions (Infrastructure as a Service -IaaS) Platform as a Service -PaaS; Software as a Service -SaaS) and services models (public, private and hybrid cloud). Besides that this study focuses on which cloud service model should SME's choose and how Chinese SME businesses should take into account their own informational structure in the age of digital transformation improving businesses performance while minimizing operational expenses and risks at the same time.

Keywords: *Cloud Computing, IaaS, PaaS; SaaS, SWOT, Cyber Security, Chinese SME sector*

1. Introduction

Currently, China's overall digitalization is in the middle of the range globally. The size of China's digital economy at 6 percent of GDP, compared to 8-10 percent in South Korea and Japan, where the IT sector is more developed and stronger in the economy. China ranks 50th out of 131 countries based on the World Bank digital adoption index, 59th out of 139 countries in the World Economic Forum index, and 36th out of 62 in the Fletcher School digital evolution index. Nevertheless, you can see diversity across sectors and regions in China, some of which are much more digitalized, such as e-commerce, fintech, IoT and cloud computing. The venture capital (VC) industry in China has grown rapidly, and increasingly focused on the digital sector. Based on experts estimations, VC in China has surged from US\$12 bn in 2011-2013 (6 percent of global total) to \$77 billion in 2014-2016 (19 percent of global total), with \$38 billion invested overseas. The main sectors that attract VC investment include big data, artificial intelligence, and Fintech. The cloud computing linked closely to these digital technologies (Zhang and Chen 2019).

The general idea of cloud computing lies in its online expansion to share, process and synchronize data from a perspective of advantages in terms of installation, configuration, updating, maintenance, costs and others. Cloud computing is perhaps the most interesting and disruptive new technology generated by the IT industry in the last 20 years, much more so than the transfer of mainframes to client or server architectures. As a consequence of the introduction of cloud computing, both the mode and the types of IT services used by businesses have changed, and SME businesses are also quickly adapting to the changes resulting from the new architecture.

Definition, approaches

There are several definition for cloud computing. "Cloud computing as a form of computing that allows flexible, scalable IT functionality to be delivered to external users as a 'service' over the Internet." (Gartner's 2022). Shared services that may be provided include Computing, Networking, Storage, Platforms and Applications. Cloud computing is a new type of application architecture adopted by enterprises in order to reduce infrastructure costs, improve efficiency, and solve capacity and scalability issues (Sharma 2022). The phrase "cloud computing" refers to the online storage and access of data. It doesn't save any information to local computer's hard drive. Data from a distant server may be accessed using cloud computing. Third-party service providers utilize the internet to provide computer resources and software tools under the cloud computing model. The consumer simply has to pay for the time they spend using the computer as well as any storage or bandwidth they use under this service model. With the aid of the internet or an interactive IT environment, many firms employ cloud computing frameworks to provide various IT services. Cloud computing may be defined simply as the process of storing and retrieving data for commercial purposes through the internet rather than a computer's hard disk (S. N. Ahmed 2013). The word "cloud" only refers to the internet as a metaphor, but it also focuses on a vast array of operational resources, such as software and hardware, which may be accessible over the internet (Mladen 2008). Cloud computing provides a variety of computer services in a commoditized form, and these services are utilized similarly to fundamental utilities like water, gas, and electricity. Accordingly, several research studies considered cloud computing to be a fundamental service that businesses employ every day to meet their fundamental computing needs (Rajkumar et al. 2009). Since this idea has evolved with the development of the internet throughout time, there is no one definition for cloud computing. No uniformly accepted definition of cloud computing exists in literature, and it is typically thought of as third parties providing computer services through the internet (Azam et al. 2013). However, cloud computing is determined by concentrating on its main benefits from both a

commercial and technological point of view. (M. Sean, et al. 2011) According to their definition, cloud computing is an IT service model that offers its clients on-demand access to both software and hardware computing services. The self-service network technology utilized in cloud computing is portable device and location independent. Without the use of personal computers or local servers, remote servers are used to store, process, and manage data that is accommodated on the internet (William 2007). The firms may access computer resources whenever they are needed without having to physically build and keep any infrastructure.

Since cloud computing is a rapidly developing concept, SMEs need have a thorough understanding of it in order to use better strategies when utilizing cloud computing services (V. Anthony et al. 2011). In essence, the notion of cloud computing is based on earlier ideas like grid computing, distributed computing, and virtualization. Although this subject of research is not very new, it may be distinguished from others based on how innovative the concept of providing computer services to the general public as a utility (William 2007). A widely accepted definition of cloud computing is provided by the National Institute of Standards and Technology (NIST) of the United States as "a model for empowering expedient, on-demand system access to a shared pool of configurable computing resources, such as servers, network, application, storage, that can be quickly provisioned and discharged with little effort of administration or interaction of service provider. This cloud model is made up of five key features, four deployment types, and three service models" (BI-Insider 2022).

Because cloud computing is a new technology, companies gradually realized the benefits of this technology. IT professionals anticipate that cloud computing will continue to rise over the next several years. Mid-sized and big businesses benefit greatly from cloud computing, but smaller businesses are already adopting it and leveraging its advantages to grow their enterprises. As businesses use these services, they receive benefits from cloud computing, which will lead to the development of IT across all SMEs, sectors, and institutions (Christof et al. 2009; Osman and Alhassan 2015).

Main benefits for different businesses applications

Cloud computing plays a significant role in resolving the effectiveness and efficiency issues that businesses face. Additionally, it supports the development and core competitiveness of businesses. Following the introduction of cloud computing, businesses will be able to more efficiently use up-to-date technology while paying less (Tiago and Maria 2010; Michael et. al. 2010). The below Table 1. briefly summarizes the future potential benefits and yields, if any company decided to integrate cloud computing solution in its running business process.

Table 1. Reasons for keep in mind the cloud computing technologies

Expected benefit	Description	References
Cost saving	Cloud computing helps to minimize operating and capital expenditures. Additionally, it helps save a significant amount of money by eliminating the need for internal server storage and meeting application requirements. Companies' operational costs, such as air conditioning, labor cost, and electricity expenditure, are also lower as there are no in-house servers or storage devices need to maintain. Hundreds or thousands of customers are clustered in the cloud, which allows cloud providers to achieve greater economies of scale and thus offer lower pay-as-you-go prices. Instead of investing heavily in data centers and servers before companies know how to use	(Qi, Lu, and Raouf 2010; Seetharaman A., and Rudolph 2013)

	them, they can pay for computing resources when they use, and only pay for what firms actually use.	
Scalability	Companies can use capacity as needed, and it only takes a few minutes to grow or shrink capacity as needed. The cloud has completely transformed how firms handle their technological resources. Firms benefit from swift resource allocation where overloading and lacking of capacity are not issues since the system is appropriately maintained by service providers.	(Gerard et al.2014)
Support innovations	Using the cloud as the backbone for innovation may enhance performance, save costs, and boost agility. Companies, for example, are driving innovation in Internet of Things (IoT) product development at a velocity that can only be done with cloud computing. Cloud computing helps the IoT sector to develop, produce, and launch new world-changing goods - and this applies to the whole IT ecosystem. Companies have access to business prospects that can help them create innovations and real-time interactions that will help their firms succeed.	(Yazn, Savvas, and Feng 2013)
Maintenance	Cloud computing may be accessed from several locations and doesn't require installation on every machine, it is simple to maintain. Platforms for cloud computing provide features that assist service providers in hosting, developing, and testing cloud-based applications. Instead of building up the system and infrastructure themselves, developers can alter and run various applications in this way.	(Christof et al. 2009)
Flexibility	Firms can easily deploy applications in multiple regions around the world. The efficacy of shared resources may be increased with the aid of cloud computing. These resources are allocated by many users, and they are also distributed dynamically based on demand. Additionally, it is credible useful to have the ability for several users and allow them to access their data from a single server and update data without purchasing a license	AWS 2022, Qi, Lu, and Raouf 2010)

Source: Own edition based on the cited references in the third column.

Based on the above facts, adoption of cloud computing can contribute to environmental conservation, meaning less servers and other resources utilized. Green data center helps to achieve energy saving and emission reduction.

2. Research methods and data

As a review paper, the authors mainly focused on the methodology based on secondary research analysing scientific publications, studies, online literature sources Fortune and relevant, Chinese and international documents (e.g. AWS, Business Insider, State Council, Ministry of Industry and Information Technology, EU), up-to date data bases (e.g. Fortune Business Insider, IMF Working Paper, Statista) as well. This study deal with the different cloud service and cloud deployment solutions, the market size of the cloud computing in China, cloud computing cyber security issues. After than, it discussed the main challanges and opportunities of the cloud comptuing solutions from the Chinese SME’s aspects. The through SWOT analysis provide signficant contribution to help SME’s to make their choice which cloud comptunig model should be the best for them. Finally, some recommendation concluded for the SME sector to

overcome the difficulties and the hidden unknown pitfall linked to apply cloud computing based technologies in their everyday's business running operations.

The conclusions and recommendations based on this „desk research” finding reflects the authors' own professional views and hopefully can contribute to understanding the specific situation of the Chinese SME sector and their attitudes toward cloud computing.

3. Main types of cloud computing models and their characteristics

Understanding how cloud computing functions, it is crucial to clarify the fundamental paradigm before explaining the kind of cloud computing (BI-Insider 2022). Cloud computing refers to a change in the way IT services are utilized and provided, allowing for more effective management of technological progress by the enterprise. The market for IT-supported services was industrialized by the development of cloud computing models because they offer flexible and affordable access to technology. These services are shared among different business organizations and retrieved by service users. Cloud computing service users can be customers, remote workers, members of organizations working locally, or the general public. Any of them can use cloud computing services with the lowest service cost (Rajkumar, James, and Gościński. 2011). In order to effectively decide on technological structure, SMEs should categorize their IT requirements into several cloud computing categories. (Subasish et al. 2017). These services cover all IT requirements for businesses that the telecommunications and IT sectors continue to assist. According to several classifications, cloud computing may be separated into two categories: a) cloud service models and b) cloud deployment models.

Cloud service models can be classified into three main categories as you can see in the below Table 2.

Table 2. Cloud service models and their features

Type	Essence of the model	Examples
Infrastructure as a Service (IaaS)	<p>While offering customers virtualized computing resources, the cloud provider hosts the infrastructure, network, storage, servers, and virtualization capabilities.</p> <p>Computational resources that are quickly available; reduces the expense and trouble of purchasing and maintaining hardware for businesses; elimination of hardware's single point of failure.</p>	<p>Amazon Web Services (AWS);</p> <p>IBM Cloud;</p> <p>Google Compute Engine (GCE);</p> <p>Microsoft Azure</p>
Platform as a Service (PaaS)	<p>In addition to offering customers development tools, the cloud provider provides the infrastructure, storage, servers, virtualization, operating systems, and development environments.</p> <p>Offers resources for testing, creating, and hosting apps.; cloud provider oversees multiple things including backups, server updates, operating systems, and server software; promotes the expansion of joint development projects; reduces reliance on infrastructure management.</p>	<p>AWS Lambda;</p> <p>AWS RedShift;</p> <p>Google App Engine;</p> <p>Windows Azure;</p> <p>Red Hat OpenShift;</p> <p>Force.com</p>
Software as a Service (SaaS)	<p>The cloud provider provides the infrastructure, storage, servers, virtualization, operating systems,</p>	<p>Google Apps;</p> <p>Dropbox;</p>

	<p>development environments, data management, and applications while giving customers access to application functionality and/or development tools.</p> <p>Use a subscription model to provide consumers applications; applications are accessible on any device and from any location; applications benefit greatly from economies of scale; software upgrades and installation are handled by the cloud provider; adapting the use of resources to the demands of the service.</p>	<p>Cisco WebEx; Office 365; GoToMeeting; Salesforce.com</p>
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Own edition based on BI Insider (2022)

A cloud deployment model is established based on who controls the infrastructure needed for the deployment and where it is located. Public clouds, private clouds, hybrid clouds, and community clouds as you can see in the Table 3.

Table 3. Implementation alternatives of cloud services deployment

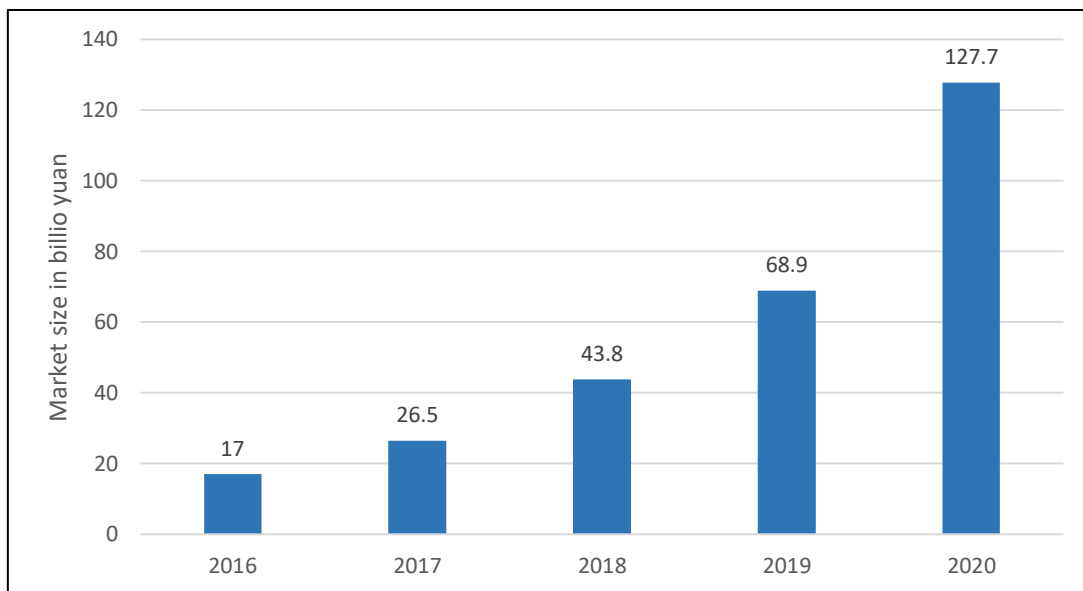
Type	Essence of the model	Examples for cloud service providers
Public cloud	<p>The utilization of hardware, storage, and network devices is shared across a number of client companies, and computing resources, hardware, software, and network devices are owned and maintained by outside suppliers. Following that, people can access computing resources over the open Internet.</p> <p>Consumers may be able to use public cloud services for free or at various subscriptions or on-demand prices, including a pay-per-use model. The public cloud gives consumers access to safe data storage, dependable network connections, and information support services.</p> <p>The public cloud brings possibilities for the business transformation of SME sector, provides almost endless space for enterprise business data storage, and provides almost endless computing power for enterprise business data processing, increasing the efficiency and effectiveness of the project management activities.</p>	<p>Alibaba Cloud, Amazon, Microsoft Azure, IBM, Google</p>
Private cloud	<p>There is no resource sharing between organizations; all computing resources, hardware, software, and network devices are used only by one entity. Users have access to computing resources via a private network.</p> <p>The private cloud is established for specific users and institutions and is only used by the construction enterprise itself. It can realize the optimization of internal resources of the enterprise, and only provide "support and technical services for the internal operation of the enterprise. Enterprises that build private clouds do not cooperate with other enterprise.</p>	<p>IBM; HP, Huawei, Inspur, Microsoft, EMC2</p>
Hybrid cloud	<p>Organizations can mix elements of each form of data center deployment by combining on-premises data centers and/or private clouds with public clouds. The use of programming technology for managing the</p>	

	connections and interactions between workloads on public and private clouds is known as cloud orchestration. With hybrid clouds, businesses may set up a private cloud to house sensitive or vital apps while using a public cloud to house less important ones.	
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Own edition based on Amazon AWS (2022); BI Insider (2022); Priya (2020)

To meet the unique demands of a certain industry or business sector, combine the computational resources of many clouds. The management of shared infrastructure across many businesses may either be done in-house or by a third-party service company. Public clouds, private clouds, and hybrid clouds are all present in a community cloud. Community clouds are also frequently set up over several administrative areas. Community clouds are available for the following industries: media, healthcare, energy, the public sector, and scientific research (BI-Insider 2022). Different cloud has different features, and benefits could provide to their users. In order to getting best cloud services and maximizing profits, companies need to evaluate their current situation, future plan, budget of IT construction to make a good decision on which type of cloud service is suitable for them to implement. The below Figure 1. indicates raising trend of the public cloud market size between 2016 and 2020.

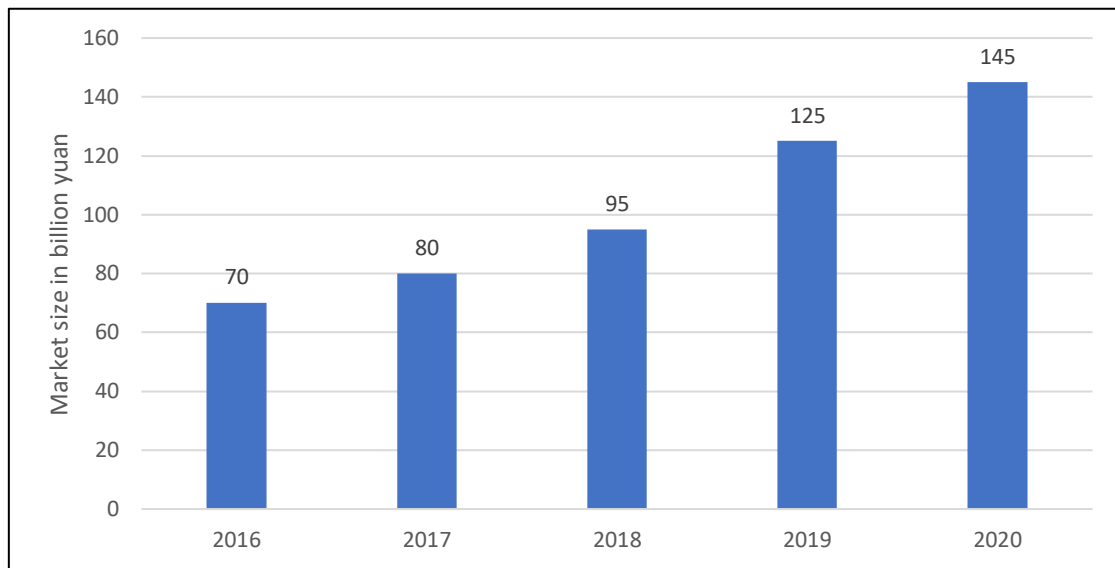
Figure 1: Size of the public cloud computing market in China in billion yuan (2016-2020)



Source: Own edition based on Statista (2022a)

The Figure 2. reveals shaping the private cloud market trend between 2017 and 2020 timeperiod

Figure 2: Size of the private cloud computing market in China in billion yuan (2016-2020)



Source: Own edition based on Statista (2022b)

4. Cloud computing and the Chinese SME sector

SME's play dominant role, making contribution to employment and producing significant part of GDP in every country around the globe. In this context, digitization means that companies choose to acquire new technological services including cloud computing solutions as a competitive advantage over their peers, which allows SMEs to reach a market segment in digital environments.

As of the end of 2021, the number of SMEs in China has reached 48 million, an increase of 2.7 times compared with the end of 2012; the number of enterprises per 1,000 people in my country is 34.28, which is 3.4 times that at the end of 2012; 3.6 times that of 2012. According to the fourth national economic census, legal person of Chinese SMEs accounts for 99.8% of all corporate legal persons. And the employment accounts for 79.4% of all enterprise employment. It owns 77.1% of assets, and accounts for 68.2% of operating income. SME sector provides more than 82% of urban employment, and provides products and services account for more than 61% of GDP, and over 50% of national profits and taxes are paid. In China, SME's independently completed more than 64% of invention patents, more than 74% of enterprise technological innovation and more than 81% of new product development (Xinhua News Agency 2019; Fortune Business Insider 2022)

4.1. IT infrastructure of SME's

The features and degrees of information technology of small and medium-sized organizations in various industries were summarized generally by Lu, Zishuai, and Yulong (2018) after conducting a comprehensive categorization of these businesses. Some small and medium-sized data centers can only execute a minimal amount of maintenance on desktop office terminals due to poor operating and maintenance capabilities. For such businesses, direct cloud service provider purchases are more appealing since they may significantly reduce personnel expenses.

Mei (2017) provided a summary of the rate of accounting information technology development in small and medium-sized businesses as well as the direction of future development. At the same time, he carried out a thorough study of the needs, benefits, and drawbacks of adopting

cloud accounting models for organizations. He used a corporation as an example to thoroughly evaluate the accounting scene of an enterprise. According to the report, the largest barriers to the growth of accounting informatization are SMEs' lack of interest in digitization and a shortage of professional skills. Finally, it is recommended that SMEs aggressively use cloud computing in the development of digitization.

Network security has been a crucial issue ever since the Internet's inception and cannot be avoided. Data center building has transitioned to the cloud computing age with the advancement of science and technology. Guangyu (2018) examined the cloud computing sector from the angle of data security. Small and medium-sized businesses need to concentrate on prevention in the process of cloud computing, he concluded after considering the weak links in information security that small and medium-sized businesses confront in the model of cloud computing risks that are concealed. Also examines the direction of information security in the future. Besides, in western countries, there are some similar research conducted. According to European Union (2016), SMEs are a significant force for innovation and expansion in the EU. IT constructions, like cloud computing, will also be most advantageous to small and medium-sized organizations because it would be difficult and expensive for them to set up in the conventional manner. SMBs usually lack a deep understanding of the potential risks of security. Additionally, SMBs sometimes lack IT and security specialists. They are unable to negotiate customized features or price or items in the contract with service providers. EU has created a guide to help SME's in comprehending the risks and opportunities they might take into account when purchasing cloud services.

Besides, before SMEs use cloud computing to implement cloud business intelligence, capabilities and key success factors of SMEs should also be considered. These will help define the important resources and skills that form strategic advantage and lead to successful cloud BI projects (Fatemeh et al. 2021).

Chun-Liang (2020) analyzed the impact of cloud computing applications on the management innovation of SMEs, including the necessity of management innovation for SMEs, the demand analysis and development status of SME's using cloud computing, and the impact of cloud computing applications on management innovation in SME's, including management concept innovation, organizational structure innovation, information technology innovation, operation management innovation and cultural innovation. The market is changing rapidly, and enterprises need to use modern IT construction to drive business in order to expand revenue, seize new business opportunities, and focus on taking larger market shares. In some very successful companies, the IT department has gone from a cost center to a core department that can deliver tangible value and differentiated capabilities. Some extremely prosperous businesses have transformed their IT departments from cost centers to a core department that can deliver tangible value and differentiated capabilities. Cloud computing plays a critical part in this transformation of IT value by enabling businesses to decrease their one-time investment and dynamically adjust resources in response to changing business demands.

Construction of enterprise-level data centers nowadays has to be service-centric, directly business-oriented, and flexible enough to fulfill "software-defined" needs. Consequently, the technological prerequisites for data center, specialized in virtualization, automation, elasticity, and metering, have also been reached to harder level to fulfill. It is necessary to implement technologies, such as network virtualization, storage virtualization, security virtualization, and have a unified management, including scheduling and metering platform in order to fully achieve virtualization technology, which is not just computing virtualization (virtual machine technology), cloud data center that is "software-defined" (Prashant et al. 2013).

Enterprises apply cloud computing technology to gradually upgrade from virtual machines using virtualized operating systems to software-defined data centers centered on cloud operating systems. In the cloud operating system, all IT resources will be pooled, and all software and hardware resources in the data center can be managed through the API interface. In a software-defined data center utilizing cloud computing technology, infrastructure resource capabilities can be flexibly expanded and changed at any time according to user needs like Lego blocks. In the cloud data center that has been implemented, users have realized the ability to maximize the use of physical servers, storage, and networks, and to ensure that IT services are at peak times. While reducing resource requirements, the actual purchase cost is minimized.

4.2. SWOT analysis of cloud computing from SME sector perspectives

Cloud computing technology has developed rapidly in recent years, especially in many large enterprises, which have been well applied and practiced. Large enterprises have reduced the total cost of IT construction through cloud computing technology and realized the optimal allocation of resources. In the strong market competition, cloud computing increases the profitability of enterprises. But for enterprises of different scales and development stages, especially for SME's, it is worth discussing whether to adopt cloud computing technology and what cloud computing service capabilities and deployment methods to adopt. SME's can use the construction experience of many large enterprises or combine the case analysis of the three enterprises mentioned in this chapter to sort out which the IT construction plan is suitable for their own development.

The following is an analysis to discuss whether SME's with stable operation adopt cloud computing technology (Andrew 2019; Roopha 2020; Franklin 2022; Sharma 2022a)

4.2.1. Strengths

Among SME's, different types of clouds are used to run their business. As observed in interviews, most organizations are currently using public clouds or private clouds that they operate and own. In the case of cloud operating systems, the commonly used by SME's is SaaS, which helps them manage business operations efficiently. It provides different services such as network capacity, storage, communication facilities. For companies who have insufficient IT resources or weak maintenance capabilities, they can rent public cloud services. This is usually a common problem for most SME's in China. If SME's adopt the public cloud service model, they will gain the following advantages:

The model of public cloud services is on-demand subscription and payment. SME's can plan and select public cloud service types according to their own needs, which can greatly reduce the operating costs of enterprises.

The use of public cloud services is relatively flexible and has strong business elasticity. When the business expands rapidly, Chinese SME's can apply for additional resources from the cloud service provider to improve business processing capabilities at any time, and can be activated and stopped at any time, allowing enterprises to take the lead in the competition.

Renting public cloud services can allow enterprises to focus more on their own business development. On the public cloud platform where all their business is hosted, a professional team will carry out operation and maintenance. Companies are no longer required to spend energy on things they are not good at. SMEs do not need to employ many IT talents. It helps to reduce the cost of labor force and training.

*Using public cloud services can enjoy 7*24 hours of services and technical support.*

Improving the efficiency of daily work in SME's. Since the data of the business system is stored in the cloud, employees can access the system at any time and place through the Internet.

Having disaster recovery backup plan. Disaster recovery is one of the classic cases of infrastructure as a service. Smaller organizations may not have another disaster recovery site, in which the cloud provider can save the company a lot of money against a catastrophic event.

Providing value-added social effects. The cloud computing center shares IT resources for many users, which can reduce the waste of overall social resources and maximize the energy saving and greener in environment protection.

4.2.2. Weaknesses

Cloud computing technology is not an exception. SME's need to fully recognize these advantages and disadvantages before making decisions. After extensive literature research and case analysis, the use of cloud computing technology has the following weaknesses:

Data security: From the perspective of data security, the most popular cloud computing vendors such as Alibaba Cloud, Amazon, Microsoft, 21Vianet, Lenovo, GDS have not completely solved this drawback. According to their own business characteristics and compliance requirements, many enterprises will still build their own data centers to monitor these sensitive data and never expose these potential risks to the public cloud platform. It is a factor that many enterprises are still under consideration in the current wave of cloud computing. Once the core data of the companies is leaked or lost, it will cause a catastrophic blow to the enterprise, including SMEs as they are vulnerable to any changes.

Cloud service providers charge by consumption, which will greatly increase the cost of use. Although cloud service providers vigorously states that resources is available anytime and anywhere and pay based on usage, when promoting public cloud products. It is flexible and convenient to expand. However, the price of use will be relatively high, which will increase total costs for these enterprises. If all data are stored on the platform of public cloud service providers, it will incur expensive internet charges, which even exceed the cost of purchasing the storage itself.

The control over business systems and data has declined. Enterprise managers hope that companies have full control and management rights over business system and data. In the process of traditional IT system construction, companies can build their own systems with their own data centers, and all applications and infrastructure are comprehensive managed and controlled. After migrating to the public cloud platform, the enterprise only needs to deploy and use the application system, which simplifies the management, but also allows the firms lose control of the entire data center and rely only on cloud service providers.

It is difficult for firms that have already carried out large-scale IT construction to expand. Many large enterprises have made huge investment in their own data center infrastructure, built a data center and a system, and purchased a large amount of software, hardware and services. For such companies, there are no need to migrate its business to the cloud data center immediately. It should comprehensively consider the actual situation of the enterprise itself, and gradually follow the plan. Thus, enterprise can complete the digital transformation under the established track and can maximize the protection of the current investments or business assets.

Cloud computing technology is not very mature yet. Although many cloud service providers stated the value brought by computing, and the products and services launched by each cloud service provider are also endless, there is no unified standard currently. When enterprises consider their own IT development plans, they cannot put all their efforts into the most popular technologies. Instead, it is necessary to comprehensively consider whether it is suitable for the enterprise development in combination with the actual situation of the enterprise. Functions provided by cloud computing also need to take into account. The future of cloud computing

still has a long way to go, and the government and industry associations need to regulate and manage this industry.

For tech startups that lack capital, IaaS is the only option. Conversely, for traditional financial systems or highly regulated and sensitive data, the disadvantages of IaaS outweigh the advantages. These kinds of workloads are best handled by in-house data center infrastructure. These applications are closely tied to legacy business systems and processes. Migrating to IaaS can be extremely disruptive. The risks of changing a stable workload environment and migrating it to the cloud far outweigh the benefits. Some organizations also want to keep sensitive data, especially user and financial information, in controlled data centers. Extending the appropriate server and network security controls to the cloud is possible but can be quite complex.

4.2.3. Opportunities

The State Council (2015b) put specific goals for cloud computing. It supports green energy and environmental preservation, encourages the adoption of the cloud computing paradigm to connect existing business and governmental IT systems, and reduces the size and number of self-built data centers. A bright spot of this paper is also how the government's role is described. The government frequently played the role of oversight in earlier schemes for economic growth. The crucial role that the government is playing in the cloud computing business is also amply highlighted in this document, along with opinions on taxation and finance. It increases the government's position as the industry's primary driver in cloud computing.

After that, policy documents related to the cloud computing have been issued one after another. The State Council (2015a) issued the document "Guiding Opinions of the State Council on Vigorously Advancing the 'Internet Plus' Action. The Ministry of Industry and Information Technology (2015) mentioned "operational services" corresponding to cloud services in the documents "Notice by the State Taxation Administration of Implementing the Administrative Measures for Promoting the Development of Small and Medium-Sized Enterprises through Government Procurement". The growth of our cloud computing has been successfully aided by the consecutive establishment of a number of governmental legislations. On the other hand, this shows the focus that the present government authorities have on cloud computing. The present policy environment for cloud computing in China has essentially been developed in certain key themes such as industrial growth, industry promotion, application foundation, and security management after the extensive implementation of cloud computing-related legislation in recent years.

From an international perspective, major developed countries also attach great importance to the development of cloud computing. The major western developed countries such as the United States and the European Union develop their own cloud computing industry. They use the government's public incentive policies to boost the rapid development of the cloud computing industry and establish a good business atmosphere. The cloud computing industry in the United States has started very early, and its products have the highest market popularity. It is the only country that fully applies cloud computing to government agencies currently. In addition, Europe and other Asia-Pacific countries are also actively using of e-government cloud, reaching a certain proportion of use. The cloud computing strategy of US government has achieved remarkable results. It can not only improve the operational efficiency of government agencies and save a lot of government expenses, but also bring huge market opportunities and significantly increase the rapid expansion of the US cloud computing industry. To put it simply, the US government drives the progress of the cloud computing industry in three aspects. It could provide Chinese regulators to consider in the future (Zhang and Chen 2019).

Cloud security issues need to be paid attention to. Besides, it is necessary to establish and improve security management and control at the policy level. Cloud security is the most important issue in the field of cloud computing. Therefore, the use of cloud computing services by government agencies requires strict security control mechanisms. It should establish industry standards, review systems, government and industry access certification, and real-time platform monitoring.

The government's policies will be appropriately ahead of the industrial development. US cloud computing strategy is decomposed into a number of policy measures which need to be implemented in various cities by many measures, such as encouraging the construction of cloud computing data centers, establishing and improving cloud computing standards, and forcing government departments to migrate their businesses to cloud centers. Each measure is implemented and checked by a specific department. The Chinese government's direction will enable the development of the whole cloud computing industry in the near future, along with a quick growth in investment in the country's cloud computing sector. For SMEs, it offers a unique opportunity. The cloud computing sector will develop in the future with a more ideal set of standards and rules, in a healthy and orderly manner.

4.2.4. Threats

Cloud computing is being promoted by an increasing number of businesses as an emerging technology that may significantly lower the cost of company information technology. At the same time, a number of new threats and challenges have emerged:

Reliability Threat. When a company outsources many services, it is difficult for SMEs to manage the reliability of IT operations on the cloud because of the high level of security risks in the environment. Service legal agreements and vendor lock-in are also the biggest threats for SMEs to adopt and implement cloud computing.

Security and Privacy Threat. Cloud computing services are used to manage different business processes of SMEs, such as managing sales data, creating payroll, managing financial records. It also helps SMEs manage R&D and provides data analytics solutions. However, risk arises when a single cloud system fails to implement secure services. SME businesses encounter security and privacy concerns. Therefore, a more reliable solution is a hybrid cloud, where automated services allow users to control their data on the network. In this way, some SMEs are properly managing the security and privacy issues of their organizations.

Threat of lacking relative knowledge. There are some managers who don't obtain knowledge of cloud computing technologies (protection of critical data, the distribution of power among various departments, the billing model, return on investment). Many businesses choose a cautious approach to cloud computing, deploying their edge business systems on the cloud platform while the core company continues to use the paradigm of self-built data centers, placing enormous operational, maintenance, and management burden on the system.

Incompatibility Threat. It is challenging to combine cloud-based corporate systems with local systems. Most businesses have already implemented IT construction in varying degrees, created their own IT systems, and developed internal usage patterns. It is challenging to fully adapt this method to the unique demands of SMEs. A significant challenge is figuring out how to connect and integrate the enterprise's current systems with those on the cloud.

Migrating threat. Migrating infrastructure and applications to the cloud is a multidimensional decision. Even though it's not just about cost, cost is often the most important factor. Organizations have to be consider the complexities of migration, including disruption to existing businesses, the intensity of application modifications, and IT's willingness and ability to embrace new management portals and processes. Cloud services have a number of benefits,

such as easy, quick, and affordable scaling, decreased maintenance intensity for operating system activities like updates and patches, avoiding capital expenditures, and usage-based pricing for more accurate cost figures. Even though this is a tricky subject, the majority of firms will discover that when business moves to the cloud, the application transfer is frequently far better than the current situation.

Selecting on cloud service provider. The cloud computing market in China has begun very recently. There is no excellent or bad among the many cloud service providers. The growth of these cloud service providers also faces several obstacles or dangers at the same time. Because of this, it is crucial for SMEs to pick an appropriate cloud service provider. Among the dangers posed by domestic Chinese cloud service providers are the following: a) Balancing the functionality of the cloud platform with the associated development expenses is a challenge that cloud service providers have to overcome. b) Cloud computing data centers place a premium on the ease of managing the data center. In cloud data centers, a vast number of services require automatic scheduling, control, administration, operation, and maintenance. The equipment that makes up the cloud data center may also include items from different brands and models, thus enhancing the data center's complexity. Users will experience significant difficulties as a result of the cloud center's poor compatibility with several brands and products, which will also make operation and maintenance more complex. c) Growing scale of cloud computing poses a significant challenge to data centers. It is impossible for us to process them with a straightforward SQL database due to the constant growth of business systems and data in cloud data centers. To address the issues in the data storage industry, there is currently no ideal solution. Utilize various technologies for either transaction processing or storage, or a combination of the two, each of which can handle a variety of application scenarios. A few workable solutions are being investigated by the current major cloud service providers. Setting restrictions on plan storage space or search time is necessary to optimize query processing because, otherwise, processing large amounts of queries would take too much time and resources. d) Sharing physical storage devices in infrastructure clouds might also result in the theft of data. The original physical limits cannot be leveraged to maintain data security since physical resources are virtualized into logical storage. Therefore, cloud data security has turned into a secret threat that most businesses are concerned about. However, it also expands the market for data security with new commercial prospects. Some business cloud services with strict security requirements are struggling to figure out how to guarantee the security of cloud data. One of the biggest cloud computing vendors, AWS, has four practices to protect cloud security as you can see in the below Table 4:

Table 4. Main cloud computing security practices and their characteristics

Security practice	Description
AWS Shared Responsibility	Cloud security is entirely distinct from on-premises infrastructure. Security of the AWS cloud depends on both the business and the cloud service provider. While the cloud is in charge of information security, the business will be in charge of determining which data should be moved to the cloud. The shared responsibility paradigm is the name given to this spirit of collaboration. The data is now more secure as a result.
AWS Global Infrastructure Security	Businesses may use a range of resources in this framework. These resources, which need to be setup, include buildings, hardware, networks, software,
AWS Account Security Features	To safeguard data from intrusion, AWS has several security features like access control, the establishment of AWS IAM user accounts, data encryption, and trusted advisor security checks.

AWS security	Service-specific	Every program and level of software has security mechanisms. As a result, any application may use cutting-edge security to safeguard data.
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Source: Own edition based on Sharma (2022b)

SME’s can use cloud computing to enhance security when they lack knowledge and capabilities. By deploying business in the cloud computing center, there are security experts and professional team specialized in security operation and maintenance for systematic security management. Public cloud service providers have creatively introduced cloud data center security solutions to aid business clients in adjusting to the changes the cloud has made to corporate systems. This will help business clients build a stable, high-performance, safe and robust cloud data center and support the steady development of enterprise cloud services. The value proposition of cloud data center network security solutions is automatic network deployment, elastic network connectivity, and sophisticated network operation and maintenance.

5. Conclusions

Cloud computing in China began later compared to other nations, but it has expanded quickly. Many information technology manufacturers have entered into this field and made concerted actions, offering SME businesses convenient circumstances and pathways to implement business cloud and digital transformation. Using cloud computing technology to build cloud data centers or rent public cloud services will bring the following advantages to enterprises.

Currently, Chinese SME’s are facing many difficulties in adopting new IT construction into their business, especially in the following two aspects: Insufficient funding and limited technical knowledge.

Chinese government has set up many external financing channels for SME’s, such as state financial appropriation, public issuance of stocks, issuance of corporate bonds, borrowing from banks. However, among these financing methods, policy has been changing, some SME cannot fulfill all the requirement to apply financing support from government, and the entry threshold for Chinese enterprises to issue bonds is quite high, and the approval conditions for public issuance of stock financing are more stringent than before, and SME’s are basically unable to obtain financial support from the above channels. However, because private lending is not supported by China’s financial supervision and legal system, and has poor ability to deal with financial risks, it has been strictly prohibited by China. Due to the limitations of funds, technology, talents and other factors, the information technology construction of SME’s has not been able to have a big change.

Additional challenge can be to implement IT construction for SMEs is due to the limited technical knowledge of managers in Chinese SMEs. Since the major transformation from the mainframe computer architecture to the C/S architecture (client-server) in the 1980s, the construction of data centers has undergone rounds of evolution. However, due to the lack of knowledge in the latest scientific and technological trend/information, the majority of small and medium-sized enterprises currently have a very low degree of digitization and their construction ideas are relatively traditional. SME’s are mainly facing the following challenges: Deployment of applications is extremely slow, Operation and maintenance are difficult, Traditional information construction requires large investment at the beginning,

The digitalization level of Chinese SME’s is still relatively low. The large number of small and medium-sized companies are facing constraints such as shortage of funds, large daily workload, and insufficient labor force. Business owners hope to improve the operation efficiency of the

enterprise, upgrade the business model, and boom the revenue of the enterprise, through the construction of information technology. However, it is exactly because of these unsolved issues that there is a tremendous market potential and opportunity for new technology such as cloud computing.

Currently, local governments are aggressively establishing high-tech parks with distinctive local features to promote local economic growth. The government stressed throughout the park's development that it should not only invest more on physical infrastructure but also work to establish a "soft environment" that is service-focused. Faced with the current competitive environment, the high-tech industrial park combines its unique qualities and develops service model innovation via the use of cloud computing technology to give small and medium-sized businesses in the park with a choice of cloud services. This will improve the ability of the established businesses to innovate, lower their overall production and operating costs, and raise the scientific park's allure to businesses.

Cloud security is an important topic and branch in the field of cloud computing. As an important part of cloud security, anti-virus has been widely used in the construction, operation and maintenance of cloud service providers. Threats to cybersecurity are constantly changing. Gaining insight into practical security strategies is able to effectively manage risk and expand business opportunities. Learning how to arm network with integrated and pervasive security is necessary to better secure critical company assets. Current service providers are already having many solution or plan to optimize safety for their business clients.

Summary

The purpose of this paper is to make overview on the overall technical development of cloud computing and introduces different choices of cloud computing services. In addition, the benefits of cloud computing for SME's operating in China were also discussed. During the past several years, cloud computing has rapidly emerged and been adopted, especially by SME's.

Cloud computing technology can reduce the IT construction and operation costs of enterprises, and has the characteristics of high efficiency, convenience, flexibility and high elasticity. It is more suitable for the enterprise development and IT demands of SME's. Enterprises need to conduct a comprehensive evaluation on business condition and current IT level to find the most suitable solution for their development. With the popularization and application of the Internet, mobile terminals, 4G networks, Internet of Things, and big data, the informatization of SME's has also shown a trend of diversification. This makes traditional small and medium-sized enterprises face the challenge of digital transformation. Proper adoption of cloud computing technology can help SME's to complete their own digital transformation and improve their competitiveness and profitability. The adoption of cloud computing technology can greatly reduce the cost of enterprise informatization construction, and at the same time improve the reliability of business systems and the speed of new business online, so that enterprise business can respond to market changes more quickly, and greatly strengthen the competitiveness of enterprises. This is a perfect opportunity for SMEs to do digital transformation. There is no standardized formula for which cloud service model to adopt. Enterprises need to choose the appropriate method according to their own situation and capabilities.

Chinese SME sector should also take into consideration the development opportunities brought by this wave of cloud computing, complete the digital transformation for themselves, and help their business to embark on the fast lane of rapid development and enter a new world. A growing trend of cloud use is seen in China, according to certain research. Despite this, numerous SME are still unsure whether to utilize cloud computing. SME's should take advantage of the country's vigorous support and take advantage of cloud computing to promote their own informatization construction.

Modern information construction and its applications can be offered by renting cloud service providers' IT resources, data storage capacities, as well as their development environments and apps. This can significantly lower organizations' IT investment. For those SME's which lack informatization professionals, weak technical strength, and limited funds, in the informatization construction, they have to customize the overall development goals of informatization according to their own business characteristics and future development strategies and complete their IT architecture design. They should evaluate their own current circumstances, select the best cloud service model fitting their needs, and maximize business efficiency, as well as hasten business growth. To foster a favorable environment for the adoption of cloud computing, service providers can intensify their collaboration with SME's that already use cloud services. The degree of confidence in service providers, which also minimising their security problems, is a crucial component for SME's adopting cloud computing.

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