Cloud Computing Opportunities and Challenges in Electronic Document Management

Aviazka Firdhaussi Azmir (iD)**, Luki Wijayanti** (iD)

Faculty of Humanities, Universitas Indonesia, Indonesia

Abstract

Background of the study: Technological developments have encouraged the creation of cloud computing technology that allows access to information from everywhere via the internet. The use of cloud computing in managing electronic documents can manage document storage without having storage specialists, reducing the need for physical storage space, and access flexibility. But behind the benefits offered, some risks must be anticipated by the organization.

Purpose: This study aims to determine the opportunities and challenges of using cloud computing in electronic document management.

Method: This study uses the Systematic Literature Review method on the literature available in the Google Scholar database from 2017 to 2022.

Findings: Based on the results of an analysis conducted on 20 selected articles, it was found that the opportunity of cloud computing in electronic document management is to increase efficiency in managing electronic documents, especially in terms of centralized document storage, increasing productivity, and response time of business processes, and cost efficiency. Meanwhile, the challenges are related to data security, system stability, authentication, and disaster preparedness, both from nature and cybercrime.

Conclusion: The research recommends that organizations using cloud computing to manage their electronic document must provide compatible and good security systems.

Keywords: Cloud Computing, Electronic Document, Electronic Document Management System.

Introduction

The era of globalization is marked by the increase in technology and information development. The use of technology in information management is very important along with industrial revolution 4.0. The emergence of various documents and media to store, search and disseminate information requires a transformation in information management technology. Digital transformation is marked by the end of the life cycle of certain business models caused by new paradigms such as cloud, big data, and industrial revolution 4.0 (Linz et al., 2017). This transformation encourages traditional organizations to use technology-based platforms for their business processes to survive in the digital disruption era. Adopting new digital technologies results in substantial changes in business processes, organizations, business domains, and societal changes in business organizations and their operating environment (Parviainen et al., 2017).

As a still developing trend, cloud computing technology is presented as an effort to allow information access from everywhere through the internet network. This new technology can overcome the limitations of previous technology. Cloud computing provides easy and transparent access to the storage infrastructure through services. The use of cloud computing offers several advantages including access to managed storage without having a storage specialist, reducing the need for physical storage space, flexibility of access, and so on. Cloud Based Electronic File Management System is a system where every subsystem in an organization can realize a shared connection through the cloud platform network. The top and bottom systems can communicate in real time over the network. Realize the logical concentration and distribution of electronic file management, and improve the efficiency of electronic document management (Han, 2021).

In line with the electronic document management system (EDMS) development, electronic documents are products from technological developments which are generated and can be read by computers, recorded as digital information, and can be used as file requirements. To increase the management of electronic documents more effectively and efficiently, EDMS emerged as an inclusive system for receiving and storing electronic documents, ensuring the authenticity, reliability, integrity, and availability of documents in the retrieval process. Cloud computing-based EDMS provides integrated electronic document management, cloud-based electronic document storage, transfer resolution, electronic document exchange, and implementation of integrated electronic document services (Zhao, 2013).

To support digital document management in the organization or company, technology-based document management is needed. EDMS is one of the strategies that can be adopted by companies that have contributed to reducing the occurrence of problems related to paper-based document management, related to information access, damage due to continuous handling or due to improper storage conditions, and even loss of information (Jervis & Masoodian, 2014).

Seeing the various cloud computing advantages, it has become an option for organizations to integrate their data storage into cloud-based systems. However, behind the benefits offered, there are also several risks such as dependence on third parties, loss of data sovereignty, and privacy and security risks. Referring to the cloud computing advantages and disadvantages in electronic documents management, it is necessary to conduct further research that discusses the opportunities and challenges of using cloud computing in managing electronic documents. This study uses the Systematic Literature Review method to review previous studies so that it can be a reference for organizations regarding the opportunities and challenges of using cloud computing in electronic document management.

Method

This study uses the Systematic Literature Review (SLR) method with a qualitative approach to literature in Google Scholar from 2017 to 2022. The analysis process consists of three stages. There are planning, conducting, and reporting stages (Adrian et al., 2016). The planning stages are identifying research questions and limitations. These stages are followed by conducting stages that trace and identify appropriate references to research, extracting and synthesizing data. The last stages is reporting, which translates and discusses the results into articles.

Developing Research Questions

These steps are included in the planning stages. In identifying research questions and limitations, researchers used the PICOC (Population, Intervention, Comparison, Outcomes, and Context) approach from Wohlin (2012). This approach can be used for systematic literature review research in social science. The research limitations support the effectiveness of searching relevant articles in answering research questions. The scope of research questions is shown in Table 1.

Table 1: Scope of Research Questions

Criteria	Scope
Population	Literature on the use of cloud computing in electronic document management.
Intervention	Limitations to the models, opportunities, and challenges that are faced in the use of cloud computing in electronic document management.
Comparison	Cloud computing models.
Outcomes	Knowing the opportunities and challenges in using cloud computing in electronic document management.
Context	Review of the research investigation results.

Referring to the scope of research in Table 1, the research questions (RQ) were determined as:
RQ1: What are cloud computing models used in electronic document management?
RQ2: What are the opportunities for using cloud computing in electronic document management?
RQ3: What are the challenges of using cloud computing in electronic document management?

Search Strategy

These steps are included in conducting stages. This study uses the PRISMA approach (Preferred Reporting Items For Systematic Reviews and Meta-Analyses) which is a data search strategy shown through the search terms used, data sources from online databases, inclusion and exclusion criteria used, assessing the quality of search results, and explaining data search results (Handayani, 2017).

Search Terms

The search term is a combination and integration of vocabulary that has synonyms using Boolean operator search methods, such as OR and AND. The search term formulation used in

this study is a combination of synonym word integration (like synonyms in English and Bahasa Indonesia) of the Boolean operator OR as shown in Table 2. Then using the integrated search structure of the AND boolean operator as shown in Table 3.

Table 2. Boolean OR

Criteria	Synonym Integration
Population	Cloud Computing OR Komputasi Awan OR Electronic Document Management OR Manajemen Dokumen Elektronik OR Electronic Document Management System (EDMS)
Intervention	Opportunity OR Challenge
Method	Study or Literature

Table 3. Boolean AND

Cloud Computing OR Komputasi Awan OR Electronic Document Management OR Manajemen Dokumen Elektronik OR Electronic Document Management System (EDMS)
Opportunity OR Challenge AND
Study OR Literature

This study uses Google Scholar as a database for literature sources. This database was chosen because it has a broad scope, making it easier to conduct searches related to research topics that are opportunities and challenges of using cloud computing in managing electronic documents. The journal articles used in this study are selected journal articles that match the research topic and meet the inclusion and exclusion criteria. The citation limits used in this study are publications from the period 2017 to 2022 or the last 5 years from the time this research was conducted.

Inclusion and Exclusion Criteria

These inclusion and exclusion criteria were used to sort out appropriate journal articles to answer this research question (Handayani, 2017). The inclusion and exclusion criteria in this study are shown in Table 4.

Table 4. Inclusion and Exclusion Criteria

Inclusion	Exclusion
All journal articles published in Bahasa Indonesia	Journal articles that were not published in Bahasa Indonesia
All journal articles published from 2017 to 2022	Journal articles that were published before 2017
Journal articles focused on research topics	Journal articles that are not within the scope of this research topic
	Duplicate journal articles

Search Results Quality Assessment

Assessment of the quality of search results aims to evaluate the quality of journal articles and the usefulness of the data obtained. The quality consists of assessment questions. Each question has three answer options, namely: Yes = 1 Partially = 0.5; No = 0 (Adrian et al., 2016). The questions that support the assessment of search results are shown in Table 5.

Table 5. Assessment Criteria based on Search Results

Level Quality	Question	Answer
Q1	Does the research explain cloud computing?	Yes/Partially/No
Q2	Does the research explain electronic document management?	Yes/Partially/No
Q3	Does the research explain cloud computing use in electronic document management systems?	Yes/Partially/No

Result and Discussion

Based on a search strategy in the Google Scholars database from 2017 to 2022, the study selection has three steps, including identification, screening, and selecting articles for the review process in this study. Firstly, there are 248 journal articles found in the database that are related to search keywords. Furthermore, researchers identified and screened the articles to exclude 24 duplicate articles, 178 not relevant articles to the search focus, 14 not fully accessible articles, and 12 articles that did not use Bahasa Indonesia. The result of the article extractions is 20 articles that will review in this research. The search strategy workflow used in this study is shown in Figure 1.
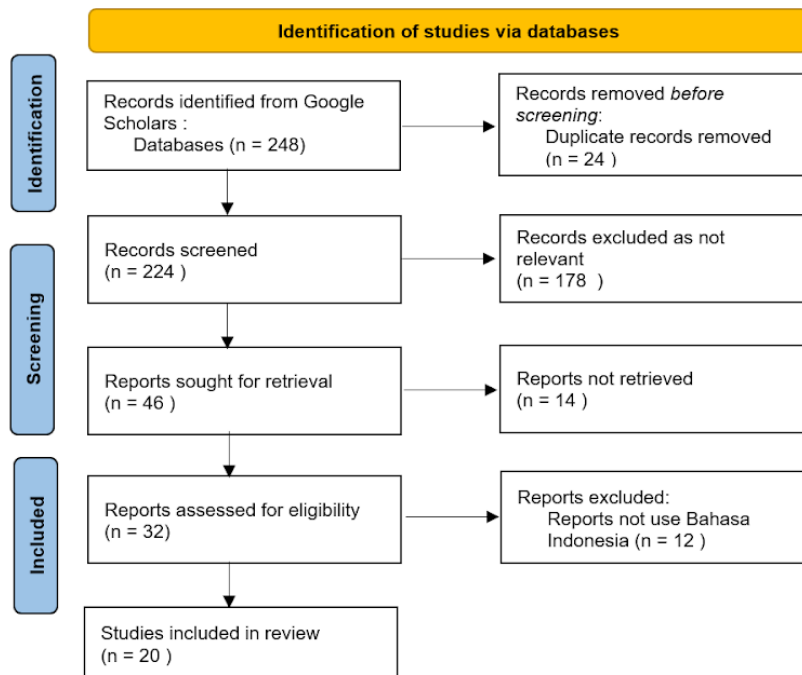

Figure 1. Search Strategy Workflow based on PRISMA

Based on the data collected and the quality assessment of the search result, the assessment result shows six articles have a value of 1 (A6, A7, A8, A9, A11, A20), one article has a value of 1,5 (A1), two articles have a value of 2 (A2, A3, A4, A5, A10, A15, A17, A18, A19), and four articles have a value of 3 (A12, A13, A14, A16). It is shown in Figure 2.
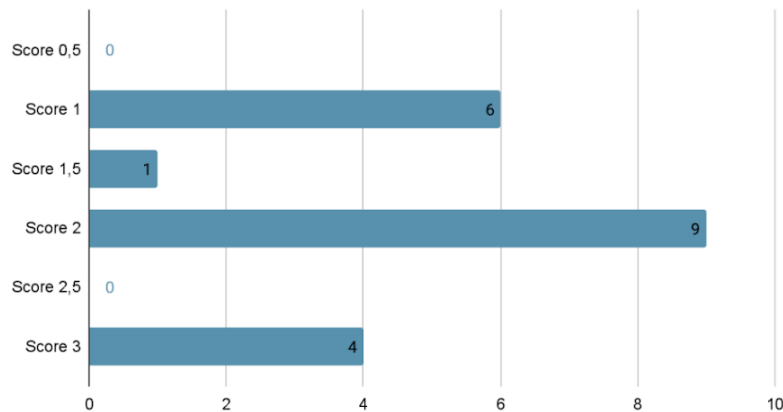
Figure 2. Search Quality Assessment Results

RQ1: What are cloud computing models used in electronic document management?

Based on the results of the analysis of the selected articles, it was found that the most widely used cloud computing model is the private cloud with a total of 11 articles (A1, A2, A5, A7, A9, A10, A12, A15, A16, A17, A19). Whereas in other cloud computing service models, it was found that 4 articles were for public cloud, 2 articles were for community cloud, and 3 articles were for hybrid cloud, as shown in Figure 3.
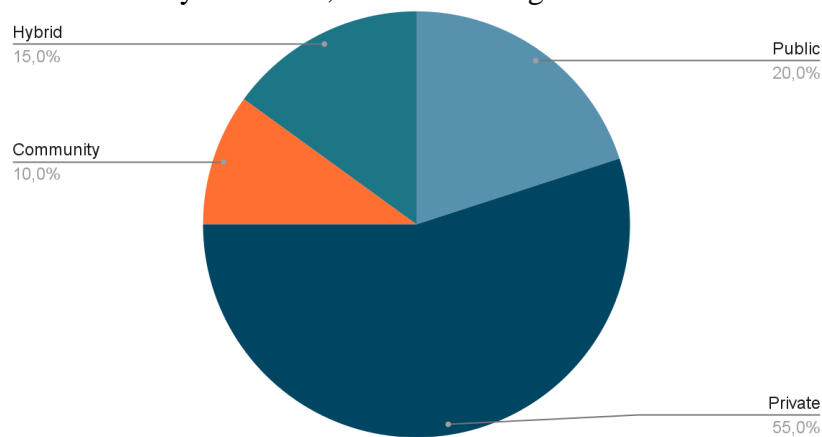

Figure 3. Findings of the Cloud Computing Service Model

The private cloud is more widely used compared to other service models because it is considered a more trusted service in terms of security. The private cloud service model allows exclusive use for the individuals and organizations who use it. In managing electronic documents, private clouds provide secure document sharing on a network that can be controlled by users. These are some of the advantages offered by the private cloud. First is the personal environment, this means that all data and documents that are in the private cloud are protected from proprietary access. In the sense that they can only be accessed by the organization's private environment and cannot be accessed by other organizations. The second is protection, the private cloud protects all confidential information and makes it more secure. Apart from that, organizations can also apply configurations or settings by modifying security according to their policies and needs. The third is supervision, the existence of software and hardware in the same location will facilitate the supervisory function with a higher scope. A comparison of the use of cloud computing in each model is shown in Table 6.

Table 6. Comparison of the Use of the Cloud Computing Service Model

Model	Scope	Administrator	Security Level	Cost
Public Cloud	Organization and General Public	Cloud Service Provider (CSP)	Lowest	According to usage
Private Cloud	Private Organizations	Private Organization	Highest	High
Community Cloud	An organization that has similar policies and security	Two or more organizations that have a similar policy	Lower than private cloud but higher than public and hybrid cloud	Medium
Hybrid Cloud	Organization and General Public	CSP and Personal Organization	Lower than private and community clouds but higher than public cloud	According to Usage

RQ2: What are the opportunities for using cloud computing in electronic document management?

Based on the results of the analysis of the selected articles, it was found that there are several opportunities for using cloud computing in electronic document management, including the availability of a document repository where the implementation of cloud-based EDMS will ensure document storage in the repository (A2). In addition, in the article (A7) it was also found that cloud computing-based electronic document management allows administrators to organize and maintain an organized folder structure to allow documents and files to be placed in folders according to their classification. Access control is also an advantage of cloud-based electronic document management. Through access control, the system can track the check-in and checkout processes to control parties who are currently accessing or editing the documents shown in the 4 selected articles, namely (A5, A8, A14, and A17). This also relates to an opportunity regarding version control found in the article (A13), where the system will track any changes that occur to the document. Version control will certainly prevent the process of unauthorized changes or loss of documents in a digital environment (Ismail et al., 2020).

The integration of EDMS with business processes or organizational workflows also allows for fast and complete information retrieval and presentation, access, and use of information by more than one user (multi-user) at the same time, more centralized information storage, and high accuracy. in storage (Suroyo, H., & Amin, 2017). This is shown in the 8 selected articles, namely (A4, A6, A9, A10, A11, A12, A15, and A20). In addition, the other 5 selected articles, namely (A1, A3, A16, A18, and A19), also found interesting opportunities for users to take advantage of cloud computing, namely enabling real-time collaboration, namely being able to perform co-authoring functions, ie editing of documents simultaneously by several people, through a web browser (Irma et al., 2017).

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RQ3: What are the challenges of using cloud computing in electronic document management?

Based on the results of the analysis of several selected articles, several challenges were found in using cloud computing in managing electronic documents which were shown in the 11 selected articles (A2, A4, A6, A10, A14, A15, A16, A17, A18, A19, A20) including dependency on third parties, system failures, companies or organizations that use technology-based systems for their operational activities are prone to connection errors or server downs. In addition, the challenges in terms of data security are shown in the 9 selected articles, namely (A1, A3, A5, A7, A8, A9, A11, A12, and A13), where document management systems based on digital technology are prone to lose either caused by internal parties such as human error (including deletion and alteration of documents intentionally or unintentionally) or manipulation and wiretapping of data by external parties. Then along with the rapid development of technology, technology becomes obsolete quickly. The very rapid development of technology is a challenge for organizations to continue to update to provide a compatible system.

Discussion

Some of the opportunities and benefits of implementing cloud computing-based electronic document management include 1) Cloud storage, in general, the available infrastructure supports document storage in a repository which can also be integrated with the organization's workflow. It can increase effectiveness and work efficiency. 2) Increase business process productivity, cloud-based EDMS can help increase worker productivity where workers can access and act on information more quickly and precisely. 3) Improve business process response time. Searching for document files, updating documents, and distributing digital documents can be done much faster with cloud-based EDMS. 4) Reduce total document cost and improve storage space efficiency. 5) Lower surcharge. By implementing EDMS, overhead costs for storing conventional documents such as paper, photocopies, and filing cabinets can be reduced to zero percent. 6) Reduce the risk of loss or damage to documents. By storing documents digitally, termites will be eliminated. Other disturbances such as fires can be minimized with more sophisticated storage systems than just conventional paper documents. 7) Document sharing. The use of documents can be done simultaneously by several users at once and allows collaboration between subsystems.

When an organization decides to manage documents electronically, several challenges will be faced such as electronic document storage which increases the risk of unauthorized access, as well as the threat of reproduction or duplication of information stored in documents, so requirements to ensure document security and access are stricter. improved. To protect the integrity, integrity, authenticity, and reliability of documents, several aspects need to be considered, such as 1) Authentication, which refers to user identification. Identification must occur bidirectionally, servers in data centers must authenticate users (automated workstations), and users must also authenticate to servers. Authentication must be enforced every time a workstation is connected to the data center. 2) Access Control, which includes determining access rights to each subsystem in the organization. Such as custodians who only have the right to write information, readers who only have access to read information, writers who have access rights to create new documents and read documents that have been created, and editors who have the right to read, write, and edit documents, and managers who have overall access including removing other users from the access control list. 3) Encryption, involves encoding information. With encryption, the information contained in the document cannot be directly read by unauthorized parties. Encryption protects all documents stored in certain information

stores from access by anyone, except for certain users who have ID and password used in encryption. 4) Digital Signature, is necessary in cases the user needs to ensure that the information received has been sent by a specific sender. Digital signatures provide assurance and co-authentication options. In addition, as a guarantee to the user that the document is not corrected during the transfer process (Daudov et al., 2021).

To protect the authenticity, authority, and access control for electronic document management using cloud computing, the organization should increase the data security by maintaining: 1) Confidentiality, the organization must check the vulnerabilities to protect the data from cyber-attacks or malicious users. 2) Integrity, Organizations must maintain and protect their available resources such as documents or client data. 3) Availability, Organization must ensure that all resources are available when it is needed. It is important to make sure that the organization can face the major issue in managing electronic documents using cloud computing such as downtime or connection errors. (Masyhur, Rizaldy, & Kartini, 2021).

Combining document management with digital-based business services to meet growing needs, leads to more complex dynamics related to data deployment and data security risks. In general, data security includes system security, personal data protection, service optimization, and the ability to make repairs and quickly mitigate if something goes wrong (Repetto et al., 2021). In the context of digital document management, the nature of digital documents that can be manipulated or errors occur in the form of changes or deletions intentionally or unintentionally indicates that document protection has not been carried out properly. So, a company needs to pay special attention to ensuring the security of its documents to prevent data loss, data corruption, and unauthorized data access, ensure data integrity, as well as the reliability and confidentiality of digital documents. Several practices can be used as a protocol to maintain the security of digital documents, including the following activities 1) Restricting access to digital documents to authorized personnel to protect document integrity and prevent unauthorized alteration. 2) Build a network security system such as a firewall, to protect access unauthorized externals (e.g., hackers). 3) Install the filter gateway software, to ensure that the filter is updated periodically to protect against spam and malicious code such as viruses. 4) Establish appropriate backup and disaster recovery system procedures for protecting digital documents. 5) Develop and implement an audit trail to detect who is accessing the system, whether specified security procedures have been followed, and to ensure that no unauthorized acts or fraud have occurred.

There are practical and theoretical implications based on the results found in this study. The implications for practice are to help organizations understand the concept of cloud computing applications for electronic document management and to make the benefits of adoption more observable. This study will help organizations realize the potential benefits and anticipate issues that need to be considered for example compatibility of the technology with organizational policy, structure, value, and most importantly products and services. Organizations will have to assess the necessity of cloud computing for their business first and then its compatibility. The theoretical implications of this research are expected to increase the literature about cloud computing applications for electronic document management. More literature on the topic of this type of study will help academics and practitioners in providing insight into the benefits and challenges of implementing cloud computing for electronic document management.

Conclusion

The use of cloud computing in managing electronic documents provides several opportunities and challenges for organizations. The main opportunities offered are increasing efficiency in managing electronic documents, especially in terms of centralized document storage, increasing productivity and response time of business processes, and cost efficiency. Cloud computing allows for the integration of electronic document management into an organization's workflow that allows each of its subsystems to collaborate and share documents without being limited by space and time.

Based on the categorization of the service model used in each organizational scope, it was found that organizations tend to choose a service model with a higher level of security, although at a higher cost. This is related to efforts to anticipate risks in electronic-based document management. The main challenges in managing cloud computing-based electronic documents are related to data security, system stability, authentication, and disaster preparedness, both from nature and cybercrime. So that in the use of electronic-based cloud computing, organizations need to consider good security systems such as protection of access rights, reliable network security systems, data backup systems, and the development of audit trails to avoid unauthorized actions in the network. In addition, the rapidly obsolete nature of technology requires organizations to continue to provide compatible systems.

This research is limited to the opportunities and challenges of using cloud computing to manage electronic documents which are analyzed through a systematic literature review with a qualitative approach. Meanwhile, to improve the accuracy of research results, further research suggested expanding research methods by combining a quantitative approach through bibliometric analysis to see the development of trends and gaps in similar research. Further research should focus to identify the issues faced by organizations when adopting the cloud, especially the prevention of security threats in the context of systems or personnel readiness, and organizational policies in the adoption of cloud computing for electronic document management.

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