International Journal of Studies in Business Management, Economics and Strategies
Volume 3, Issue 4, April - 2024
ISSN (E): 2949-883X
Scholarsdigest.org

THE ROLE OF MODERN TECHNOLOGIES AND CLOUD COMPUTING IN ENHANCING THE SECURITY OF ACCOUNTING INFORMATION SYSTEMS

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Abstract
The aim of this research is to provide an overview of the role of modern technologies and cloud computing in enhancing the security of accounting information systems. The researchers employed a descriptive analytical approach and collected primary data through a questionnaire. The questionnaire was distributed to a sample of professionals and academics in the fields of financial accounting and information technology systems who have knowledge and experience in the field of information technology and digital aspects. The data were then analyzed by using SPSS software to test the research hypotheses. The research arrived at several conclusions, where the most important one is that there is a statistically significant effect of cloud computing on the security of accounting information systems. Cloud computing technologies are widely recognized as a valuable tool for enhancing the security of accounting information systems, serving as a strong defense against electronic crimes and accounting fraud, while also preserving the principles of accounting information systems security. To further advance in this field, a series of recommendations were formulated, with particular emphasis on the need for continuous research in cloud computing technology. The importance of accounting information and its effectiveness cannot be overstated, especially in light of the increasing demand for these services. It is essential to explore the interconnection between cloud computing technology and other related domains such as electronic, digital, and internet services and web services. This will help generate greater scientific interest and draw the attention of specialists and accounting authorities to the importance of establishing accounting and auditing standards for accounting information systems services, similar to those applied in advanced countries.

Keywords: Modern Technologies, Accounting Information Systems, Cloud Computing.

Introduction

In light of the tremendous technological development that the world is experiencing and the emergence of modern digital accounting technologies, the so-called cloud computing technology has emerged. Cloud computing, as a technological method, provides a large storage space for accounting information and its circulation through external servers. As a result, companies can benefit from registering their data on the cloud, accessing it at any time, conducting analysis on stored data, and utilizing pre-developed software at minimal costs. Cloud providers will need to adapt procedures and provide security especially on issues of encryption, transparency, and confidentiality.

The first section: The scientific research methodology

First: The research problem

The problem of the current research can be formulated with the following questions:

- What is the nature of the importance of modern technologies and cloud computing?
- Does the use of cloud computing technology affect enhancing the security of accounting information?

Second: The research importance:

The importance of research lies in providing security levels for this kind of information by developing encrypted digital methods that possess traceability directly through controlling dimensions of time, effort, cost, and processing speed, leading to instant digital processing. This aims at combating accounting fraud, managing cloud computing risks, and enhancing and strengthening the security of accounting information.

Thirdly: Research Objectives:

1. To explore the philosophical literature related to modern technologies and cloud computing.
2. To identify the fundamental elements of security provided by cloud computing technology to enhance the security level of cloud computing.
3. To elucidate the impact of modern technologies and cloud computing on improving and strengthening the effectiveness of the security of accounting information systems.

Fourthly: Research Hypothesis:

The research is based on the following hypothesis:

"There is a statistically significant effect between cloud computing technologies and the effectiveness of the security of accounting information systems."

Fifth: Research methodology:

The researcher adopted a descriptive-analytical methodology to obtain primary data for the study through a structured questionnaire prepared and distributed to a sample of academics and professionals in the fields of financial accounting and information technology systems. Those academics and professionals are interested in information technology and digital

aspects and utilized the SPSS software to collect and analyze data to test the validity of the research hypotheses.

The second section: The theoretical framework

The first requirement: The philosophical framework of cloud computing technologies

2.1.1. Emergence of Cloud Computing: The field of cognitive accounting has proven to be an innovative and receptive area for innovations in information technology. Undoubtedly, cloud computing technology has the potential to reshape the accounting software market with the trend towards adopting cloud computing technology becoming a reality. Cloud computing is on the rise, and cloud-based accounting software ensures the same functionality traditionally provided by locally installed accounting software on the user's personal computer (Yousefi & Qattal, 2021: 364). The use of cloud computing began in the late 20th century, particularly by the innovative scientist Ramnath Chellappa in 1997. Subsequently, the Amazon Web Services (AWS) platform was introduced based on the concept of utility computing in 2006. Following these endeavors, IBM and Google, in collaboration with several universities, embarked on a joint research project on cloud computing, specifically in 2007.

2.1.2 The concept of cloud computing: We can define the concept of cloud computing as a group of technology servers linked together and managed centrally over a local network or the Internet. It is used as a service that is subscribed to through the Internet service, and not as a final product that can be purchased and installed on the user's device, whether an individual or a company. Moreover, it is called the cloud that provides modern computing services to the community of user clients.

This cloud can be located in a specific place or spread across several places. (Hassan, 2020: 464-465). The concept of cloud computing technology can be professionally and more formally summarized and defined by the National Institute of Standards and Technology (NIST) as "a model used for enabling ubiquitous, convenient, on-demand network access to a shared pool of usable computing resources. For example, networks and servers." "and storage, applications, and services that can be provisioned and released quickly with minimal administrative effort or service provider interaction." These resources are provided over a network, requiring interaction among users and service providers (Ryoo, et. al., 2015: 68).

The main idea of cloud computing is to outsource the management and delivery of software and hardware resources to third-party companies (cloud suppliers), which specialize in that particular service and can provide a much better quality of service at lower costs in a convenient manner (Arjun & Vinay, 2018: 6). .

2 .1 .3 Types of cloud computing services: The National Institute of Standards and Technology (NIST) has been the official sponsor of the topics and concepts of technology and information systems since 2002 and its standards, including the topic of cloud computing. The cloud computing services are divided into three main sections (Al-Shamrani and Al-Asmari, 2021: 249; Mell & Grance, 2011: 2), as follows:

1. **Software as a Service (SaaS)**: It is the ability provided to consumers to use the provider's applications that run on cloud infrastructure. These applications can be accessed from a variety of client devices through a thin client interface such as a web browser (such as web-based email) or a software interface. The consumer does not manage or control the underlying cloud infrastructure, including networks, servers, operating systems, storage, or even the functionality of individual applications, except for the user's limited application configuration settings.

2. **Platform as a Service (PaaS):** The ability provided to the consumer to deploy on cloud infrastructure applications created or acquired by the consumer using programming languages, libraries, services and tools supported by the provider. The consumer does not manage or control the underlying cloud infrastructure including the network, servers, operating systems, or storage, but rather controls the deployed applications and possibly configuration settings of the application hosting environment.

3. **Infrastructure as a Service (IaaS**): It represents the ability provided to the consumer to provide processing, storage, networking, and other basic computing resources. The consumer is able to deploy and run arbitrary software, which can include operating systems and applications. The consumer does not manage or control the underlying cloud infrastructure but does control the operating systems, storage, and deployed applications. There may be limited control over specific networking components (i.e, host firewalls).

2.1.4 Types of cloud computing technologies: Cloud computing is divided in terms of the service provided into four main types as follows: (Al-Shamrani and Al-Asmari, 2021: 249; Louwers, et. al., 2015: 862)

1. Public Cloud: It is described as cloud computing services from the provider and accessible over the Internet or a private network. The cloud uses systems in one or more data centers, is shared among many customers, and has varying degrees of data privacy controls.
2. Private Cloud: The architecture of private cloud is designed similarly to that of public cloud, yet built, managed, and used internally by a company. It uses a shared services model with variable use of a shared set of virtual computing resources. Furthermore, data is controlled within the project.
3. Hybrid cloud: It is a combination of cloud services for providers or suppliers, internal cloud computing structures, and traditional IT infrastructure, forming a hybrid model that uses the best technologies to meet specific needs.
4. Shared cloud or community cloud: The infrastructure of cloud technologies is shared among many organizations and supports specific communities with common interests (e.g., mission, goals, security requirements, policies, and compliance considerations). It may be managed by the company or a third party, and may be located inside or outside the company's headquarters.

2.1.5 Advantages of cloud computing: Cloud computing technology, as a modern contemporary technology, is characterized by a set of advantages, including (Al-Shamrani and Al-Asmari, 2021: 249):

1. Cloud computing is easy to use and implement and does not require economic units to purchase, install or maintain the relevant hardware and software licenses.
2. Reduces costs associated with using fixed servers or application development due to the speed with which cloud computing technology handles contemporary updates and upgrades on the Internet.
3. Users of cloud computing technologies can access their resources and obtain their data and applications anytime and anywhere through Internet services.
4. Cloud computing provides reasonable flexibility in terms of the user's ability to access many available applications and services and the possibility of sharing resources through the services of this contemporary technology.
5. Cloud computing is characterized by providing reliable, flexible infrastructure and high-quality services to cloud users in academic and commercial environments.

2.1.6 Challenges of cloud computing: There are a number of challenges that need to be addressed in order to achieve the goal of adequate security, as the basic concepts of information security are confidentiality, integrity, and privacy, known as CIA. It is a very important concept that was developed in an accounting environment using agency theory to manage a manager's self-interest and inter-firm transactions. Agency theory recognizes the need to align the goal of the agent with the principal, although this is difficult to achieve in practice, and cloud security is no different, which indicates the need for a different approach. Accordingly, security challenges have been identified (Duncan & Whittington, 2016: 125), as follows:

1. Determine the security objectives of accounting information systems.
2. Compliance with international electronic standards in the field of smart governance of information technology.
3. Contemporary cloud audit issues.
4. Management approach.
5. Technical complexity of cloud computing.
6. Lack of responsibility and accountability.
7. Appropriate measurement and objective monitoring.
8. The position of company’s management towards the security and privacy of accounting data and information.
9. Security culture in the company.
10. Threat to the internal and external environment.

2.1.7 Characteristics of cloud computing: There are a set of main characteristics that are used to distinguish cloud computing, which are a set of characteristics specific to cloud computing. They are: (Mell & Grance, 2011: 2)

1. On-demand self-service: The consumer can provide computing technology capabilities from one side only, such as the timing of utilizing the server and network storage, and based on need, automatically and simply, without the need for human interaction with each service provider.

2. Rapid elasticity: Capacities can be provisioned and released flexibly, and in some cases automatically, to scale outward and inward quickly in proportion to demand. To the

consumer, the possibilities for supply often seem unlimited and can be customized in any quantity at any time.

3. Broad network access: Functionality is available across the network and can be accessed through unified or standardized mechanisms, facilitating the use of heterogeneous thin client or thick client platforms (such as mobile phones, tablets, laptops, and workstations).

4. Resource pooling: Through the multi-tenant model, a provider's computing resources are pooled to provide services to multiple consumers. Various physical and virtual resources are dynamically allocated and reallocated according to the needs of consumers. There is a sense of location independence because the customer typically has no control over the exact location of available resources, but may be able to determine location at a higher level of abstraction, i.e, country, state, or data center. Furthermore, storage, processing, memory, network bandwidth, and their consumers are examples of resources.

5. Measured service: Cloud systems automatically control and optimize resource usage by leveraging scaling capacity at a certain level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth, and active user accounts). Resource usage can be monitored, controlled, and reported, providing transparency to both providers and consumers of the services being used. The distinctive features of cloud computing technology can be clarified with a consistent and common concept in the computing management process, as shown in Figure (1) as follows:

The second requirement: An Introductory Insight into the Security of Accounting Information Systems

2.2.1 Concept of Accounting Information Systems Security: It refers to a set of preventive measures and precautions used, including technical or preventive measures, to safeguard information, devices, and software, as well as procedures related to safeguarding the human resources in this field. It is essential to protect accounting information and the system itself from loss, risks, and theft. In order for accounting information to be useful in the decision-making process, this system must be credible and reliable (Abdul Latif & Mohammed, 2021: 167).

In general, the security of accounting information systems (Whitman & Mattod, 2011: 62) is divided into:

1. Physical Security: It involves resources, assets, and buildings to prevent unauthorized access.
2. Personnel Security: To protect individuals and groups who have the right to access information.
3. Operational Security: To protect activities and operations performed by authorized personnel.
4. Communications Security: To protect media, technologies used, and content.
5. Network Security: To protect network components, transmissions, and content.
6. Data or Information Security: To protect the confidentiality, integrity, and availability of data or information.

2.2.2 Principles of Credibility in Accounting Information Systems Security: The conceptual framework for the elements of reliability and credibility, as proposed by both the American

Institute of Certified Public Accountants and the Canadian Institute of Chartered Accountants, outlines five principal principles that undoubtedly contribute to enhancing the credibility of accounting information systems security (Steinbart & Romney, 2018: 342). These principles are as follows:

1. Security: It means controlling access to the system and its data.
2. Confidentiality: It ensures that sensitive information is protected from being disclosed to unauthorized individuals.
3. Privacy: It means that customer's personal information is collected, used, and disclosed appropriately.
4. Integrity of Procedures: It ensures that information is handled accurately and completely, with appropriate authorization procedures defined.
5. Availability: It means that the system is available to fulfill operational requirements and commitments.

2.2.3 Components of Information Systems Security in Accounting: Experts and specialists in the field of accounting information systems security believe that there are three components, known as the triad of information systems security, which are equally important. If any of these components are violated, it can be concluded that the information may have been threatened or at risk. These components (Al-Hussein, 2017: 27) are as follows:

1. Confidentiality of Information: It encompasses all essential procedures to prevent unauthorized access and disclosure of sensitive or confidential information.
2. Integrity of Information: It ensures that all information has not undergone any intentional or unintentional deletion or alteration, either entirely or partially, at any step of processing or exchange.
3. Availability of Information: It means providing access to those who are entitled to it and ensuring accessibility, which can occur at the appropriate time.

The fourth topic: The impact of cloud computing technology on the effectiveness of accounting information systems security

Sa'id and Nadia (2018) mentioned that cloud computing technology is considered one of the transformative technologies that seek to improve business practices efficiently and effectively. Adopting such technologies provides numerous opportunities for companies of all sizes and shapes. Additionally, implementing cloud computing in developing accounting information systems will have a significant impact on the development of these systems, facilitating their use and utilization over time. Cloud computing, which is one of the latest trends in the world of information technology, offers a new model that reduces the complexity of IT by providing on-demand computing services anytime, anywhere over the Internet according to software and data security standards. It aims to serve businesses by increasing performance, reducing costs, increasing storage capacity, and facilitating access wherever there is internet connectivity (Sa'id and Nadia, 2018: 1-7).

The third topic: The practical aspect

The researchers relied on a questionnaire form that included two variables as follows:

- The independent variable represents: Cloud Computing Technologies.
- The dependent variable represents: Accounting Information Systems Security.

3-1. Research Sample:

The research sample consisted of a group of specialized professors totaling 80. The questionnaire included 16 questions measuring two axes.

Table (1): The distributed and retrieved questionnaire forms that were subject to the analysis process.

Research sample	Distributed forms		Retrieved forms		Forms subjected to analysis	
Professionals and academics	Rate	No	Rate	No	Rate	No
	% 100	80	% ,	78	% ,	78

Source: The table was prepared by researchers.

3-2 Testing the research measurement tool:

3.2.1. The stability of the research measurement tool.

According to (Sekaran, 2003, p85), Cronbach's Alpha coefficient was calculated to measure the validity and reliability of the research sample's responses to the questionnaire. The statistically acceptable value for this measure indicates it should be 60% or higher according to the following table:

Table (2): Internal consistency coefficient values for the items of the research tool

Axes	**Reliability coefficient (Cronbach's (alpha**	**No. of questions**
The first axis/cloud computing technology	0.713	8
The second axis / security of accounting information	0.849	8
The general stability of the questionnaire	0.865	16

Source: The table was prepared by researchers based on electronic calculator outputs.

From Table (2), we observe that the values of Cronbach's alpha coefficient for the research tool items ranged between 0.713 and 0.849, with an overall alpha value for all items of 0.935. Consequently, all values exceed 60%, indicating consistency among the research tool items and the reliability of the research tool. Thus, it can be relied upon for statistical analysis.

3-2-2 Descriptive statistics for research variables:

This paragraph includes a descriptive statistical analysis of questions for the three research axes, which number (16) in number, using measures of central tendency, which are both the arithmetic mean and the standard deviation of the extent of agreement or disagreement, and the order of relative importance of the questionnaire items, as follows:

The first axis: Cloud Computing.

Table (3): Descriptive analysis of the cloud computing axis

Question No	Level of responses					Arithmetic mean	Standard deviation	Relative importance	Sequence of relative importance
	Disagree	Strongly disagree	Neutral	Strongly agree	Agree				
1	-	-	2	18	48	4.24	0.492	84.8	5
2	-	-	3	25	40	4.32	0.598	86.4	3
3	-	-	2	23	43	4.31	0.526	86.2	4
4	-	-	9	19	40	4.15	0.629	83	7
5	-	-	3	13	52	4.15	0.466	83	6
6	-	-	12	20	36	4.12	0.681	82.4	8
7	-	-	3	30	35	4.4	0.577	88	2
8	-	-	3	34	31	4.46	0.584	89.2	1
Arithmetic mean, standard deviation, and relative importance of the axis						4.269	0.5692		

Source: The table was prepared by researchers based on electronic calculator outputs.

The results of analyzing the research sample responses in Table (3) indicate that the axis of cloud computing technologies obtained an arithmetic mean of (4.269) and a standard deviation of (0.5692). This indicates the consensus of the sample responses around the arithmetic mean value, reflecting the agreement of the research sample with the questions of this variable. Therefore, it can be said that the general direction of the cloud computing technology axis is affirmative.

The paragraph (8), which states that "Cloud computing technologies aim to provide information that contributes to increasing understanding and effectiveness of information users, as well as sustainable prediction of returns and profits", was ranked first with a standard deviation of (0.584) and an arithmetic mean of (4.46). In the second rank, paragraph (7) states that "Cloud computing technology saves a lot of time and effort, thus reducing costs through the speed and accuracy of information execution and delivery at any time." It has a standard deviation of (0.577) and an arithmetic mean of (4.4). Paragraph (3), which indicates that "Cloud computing completely changes the shape of accounting information systems, making them available at lower costs and easy to use, with the ability to develop them by cloud service providers" was ranked third with a standard deviation of (0.598) and an arithmetic mean of (4.32).

The second axis. Security of accounting information systems:

Table (4): Descriptive analysis of the accounting information systems security axis

Question No	Level of responses					Arithmetic mean	Standard deviation	Relative importance	Sequence of relative importance
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree				
1	-	-	-	44	24	4.35	0.481	87	1
2	-	-	3	38	27	4.35	0.567	87	2
3	-	-	4	40	24	4.29	0.575	85.8	4
4	-	-	6	41	21	4.22	0.595	84.4	7
5	-	-	7	34	27	4.29	0.648	85.8	5
6	-	-	12	41	15	4.04	0.633	80.8	8
7	-	-	3	39	26	4.34	0.563	86.8	3
8	-	-	3	44	21	4.26	0.36	85.2	6
Arithmetic mean, standard deviation, and relative importance of the axis						4.27	0.553		

Source: The table was prepared by researchers based on electronic calculator outputs.

The results of the analysis in Table (4) indicate that the axis of accounting information systems security obtained an arithmetic mean of (4.27) and a standard deviation of (0.553). This suggests that the sample responses agree on the mean value, indicating consensus among the research sample on the questions related to this variable. Moreover, the overall trend of the accounting information systems security axis is consistent. Paragraph (1), which states "Accounting information systems provide predictive financial information that helps in formulating future plans," ranked first with a standard deviation of (0.481) and arithmetic mean of (4.35). Paragraph (2), which states "Cloud computing technology represents the foundation of robust financial information systems," was ranked second in the second place with a standard deviation of (0.567) and arithmetic mean of (4.35). Paragraph (7), which states "Cloud computing provides high data reliability compared to personal computers, making cloud computing more reliable," was ranked third with a standard deviation of (0.563) and arithmetic mean of (4.34).

This is why we find that cloud computing is more reliable (with a standard deviation value of (0.563) and an arithmetic mean value of (4.34).

3-2-3 Testing hypotheses:

Testing the main hypothesis:

To test the hypothesis, researchers use simple linear regression analysis to predict the effect of the independent variable (cloud computing technologies) on the dependent variable (accounting information systems security). The table below shows the results obtained from the multiple linear regression analysis with an explanation of the most important results:

Table (5): Determining the correlation coefficient for simple linear regression for the second hypothesis

R Square	R coefficient
0.386	0.621

Through Table (5), it is evident that the correlation coefficient (R) between the independent variable and the dependent variable reached (0.621), which is a strong value indicating the strength of the relationship among the independent and dependent variables. Additionally, the table shows the value of (R Square) which equals (0.386), indicating that the independent variables were able to explain approximately (38.6%) of the variance or factors influencing the dependent variable, whereas the remaining portion is attributed to other factors such as random error.

Table (6) **ANOVA[a]** the statistical significance test for the simple linear regression of the second hypothesis

Degree of freedom (df)	calculated F	Sig.
1	41.4	.000b
67		

The table above indicates that the F value equals 41.4, which is smaller than its calculated T value according to the degrees of freedom (df) (66) at a significance level Sig. of 0.000,

which is less than 0.05. This confirms that the regression has statistical significance and is statistically significant, indicating the appropriateness of the model used.

Table (7) The simple linear regression of the second hypothesis

	Regression coefficient B	Beta	calculated T	Sig.
Regression constant	1.018		2.007	.000
Cloud computing	0.762	0.621	6.436	.000

As evident from Table (7), the regression coefficient is (.762), with a calculated t-value of (6.436), reflecting the nature of the sample members' responses. Additionally, the significance level is (.000), which is less than (.050), indicating that the sample data provided convincing evidence to accept the hypothesis of statistically significant impact. This means that the second research hypothesis, which states that "There is a statistically significant effect between modern cloud computing technologies and the effectiveness of accounting information systems security" was accepted.

Fourth Section: Conclusions and Recommendations

Firstly, Conclusions:

Firstly, the researcher reached several conclusions based on the presented findings:

1. Cloud computing technologies aim to provide useful information that contributes to enhancing the understanding and effectiveness of information users, as well as sustainable prediction of returns and profits, with relative importance reaching 89%.
2. Modern cloud computing technologies provide users with significant time and effort savings, contributing to cost reduction through the speed and accuracy of information execution and delivery at any time.
3. Cloud computing revolutionizes accounting information systems entirely, making systems more accessible at lower costs and easier to use, with the ability to be further developed by cloud service providers, with relative importance reaching 86%.
4. Accounting information systems provide predictive financial information that aids in formulating future plans.
5. Cloud computing offers high data reliability compared to personal computers, making it more reliable with a relative importance of 86%.

Secondly, Recommendations:

Based on the conclusions drawn, the researcher recommends the following:

1. Iraqi companies listed on the stock market should adopt cloud computing technologies to develop and restructure their electronic operations and enhance their activities.
2. It is essential to keep pace with and monitor research in cloud computing technologies due to its significant importance in the fields of accounting information systems and their effectiveness.

3. Companies listed on the stock market should focus on establishing IT departments and providing skilled personnel in the field of information technology.
4. It is essential to draw the attention of officials at the Federal Financial Supervisory Authority to the importance of issuing accounting and auditing standards in the field of accounting information systems services, similar to the standards adopted by advanced countries in this vital and important field.
5. Universities, colleges of management and economics, and their diverse scientific departments should pay attention to the necessity of highlighting these contemporary topics and integrating them into the curriculum of accounting information systems and auditing.

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