

Examining the Impact of Cloud Computing Adoption on Internal Audit Effectiveness in the Jordanian Industrial Companies

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Abstract. The adoption of cloud computing has transformed the provision of data to users, ensuring both quantity and quality, along with standardizing the timing of data presentation. This shift aims to reduce data asymmetry and enhance performance efficiency across all companies dependent on data. Specifically, within the industrial sector of Jordan, the adoption of cloud computing is anticipated to address the unique needs of companies, thereby influencing the effectiveness of internal audits. Despite the critical intersection of cloud computing adoption and internal audit effectiveness in industrial companies in Jordan, no prior research has explored this nexus. To bridge this gap, our study involved distributing questionnaires to (260) managers in industrial companies. The analysis, conducted using SPSS, revealed a positive and significant correlation between cloud computing, encompassing Infrastructure as a Service, Programs as a Service, and Storage as a Service, and the effectiveness of internal audits in Jordanian industrial companies. This research contributes significantly to the existing literature by empirically investigating the relationship between cloud computing adoption and internal audit effectiveness in industrial companies specifically situated in Jordan.

Keywords: cloud computing Adoption, Internal Audit Effectiveness.

1. Introduction

Cloud computing plays a crucial role in electronic governance, facilitating information exchange and service delivery by allowing users to access information systems over the internet without expertise in infrastructure management. Although not a new technique, cloud computing provides a novel approach to utilizing computing resources and software as services, sparing users from complexities in infrastructure operations. This technological model is vital for addressing challenges in digital transformation and service provision, enhancing organizations' ability to meet customer demands with resilience and higher quality.

However, the adoption of cloud computing by businesses should be gradual and well-balanced, considering the increasing reliance on technology in service delivery. It introduces various risks, necessitating organizations to strengthen internal audit practices and employ risk management strategies, as highlighted by Nurhajati (2016). In managing these risks, a focus on vulnerable areas related to new information technology is essential. Data confidentiality is critical, requiring organizations to prioritize the implementation of robust quality control systems. Internal auditors must possess comprehensive knowledge of cloud computing and associated risks to fulfill their roles effectively, impacting traditional systems like internal audits significantly.

Cloud computing, characterized by its provision of diverse services and resources via the internet, has become a cornerstone technology offering convenience, flexibility, and cost savings to organizations. Mahmoud (2017) underscores the critical significance of data security, emphasizing the imperative for robust security measures and effective risk management. Concurrently, Nurhajati (2016) identifies cost savings and enhanced data accessibility as primary drivers fostering the growth of cloud computing.

In the realm of business transformation, particularly for SMEs, cloud accounting emerges as a game-changer. Abu Tarboush (2017) accentuates the cost-effectiveness and user-friendliness of cloud-based solutions, positioning them as transformative tools. Despite acknowledged concerns regarding information and data security, literature suggests that the benefits of cloud computing outweigh these risks for many accountants and organizations. Nasri (2019) and Neicu (2020) further emphasize core objectives of cloud computing, such as cost-effective services and the elimination of the need for specialized personnel. Inggarsono et al. (2018) delve into how cloud computing obviates the necessity for in-house infrastructure and substantial capital investments, reinforcing the idea that cloud services present a scalable and resource-efficient alternative to traditional solutions.

The existing literature lacks comprehensive research specifically addressing the impact of cloud computing adoption on internal audit effectiveness within Jordanian industrial companies. This study aims to fill this gap by exploring the unique business environment and regulatory landscape in Jordan to understand the distinct challenges or opportunities associated with the adoption of cloud technologies in internal audit processes.

Another gap in the literature pertains to the variability of cloud computing adoption effects on internal audit effectiveness across different industries in Jordan. This study seeks to investigate whether certain sectors face more significant challenges or realize more substantial benefits from adopting cloud technologies, providing insights into industry-specific implications for internal audit practices.

The primary objective of this study is to enhance the system of internal control in Jordanian industrial companies. This will be achieved by leveraging cloud computing mechanisms, specifically "Infrastructure as a Service, Programs as a Service, and Storage as a Service." The research aims to contribute valuable insights to address the identified research gaps and optimize internal audit processes for long-term performance and sustainability.

2. Literature Review

The provided literature sources offer a comprehensive perspective on cloud computing, data security,

and their implications for internal audit and business organizations. Here is a critical analysis of the key points from these sources:

2.1 Cloud Computing Overview

This critical examination explores a compilation of studies investigating the integration of cloud computing services by Small and Medium Enterprises (SMEs). These studies encompass diverse aspects of cloud computing adoption, including its advantages, disadvantages, risks, and implications for SMEs in various geographical regions. The review aims to assess the content, organization, and academic rigor of the provided studies, offering proofreading suggestions where applicable.

Initiating with a focus on the crucial connection between cloud computing and internal audit, the review incorporates Yati Nurhajati's study (2016) as a credible source. However, it would be beneficial to briefly outline the key findings of this study. Reference to Slater and Woerner's work (2012) regarding the role of internal audits in cloud adoption is pertinent but could benefit from a brief explanation of their contributions to the field. While the analysis effectively highlights the benefits of cloud computing with a reference to Savaraj (2016), providing a concise overview of specific benefits discussed, such as cost reduction and improved data accessibility, would enhance understanding. The mention of security challenges related to cloud computing, supported by Turki & Qasim (2018) and Hu et al. (2016), strengthens the argument. Nevertheless, a succinct summary of the major security concerns raised in these studies would improve clarity.

The analysis proficiently outlines the positive impact of cloud computing on SMEs, citing examples from Algrari (2017), Hou et al. (2019), Han (2014), and Khanom (2017). However, including specific details on how cloud adoption positively influences customer welfare and organizational performance would bolster the argument. The introduction of studies by Neicu (2020), Wahyuni (2018), Inggarsono et al. (2018), Dordevic (2018), Vasiljeva et al. (2016), Weng et al. (2015), and Agundez et al. (2014) adds valuable perspectives to the analysis. To enhance coherence, it is recommended to briefly summarize the key findings of each study and explain how they contribute to the overarching argument (Dordevic, 2020; Vasiljeva, 2016).

2.2 Influence of Cloud Computing on Accounting Information Systems

This compilation of research offers a thorough examination of the influence of cloud computing on accounting information systems, particularly within the sphere of service companies, SMEs, and the diverse challenges encountered across various regions. Each study is analyzed individually below:

In the investigation conducted by Abd El Rahman and Alhelo (2022), the primary aim was to explore the influence of cloud computing on the effectiveness of accounting information systems within service companies amid the COVID-19 pandemic. The results indicate a favorable impact on the efficiency, security, and dependability of accounting information systems. While the study's pertinence in the context of the pandemic is noteworthy, a more comprehensive examination of potential limitations or challenges faced by companies could offer a more nuanced perspective. Wahyuni (2018) highlighted the positive intentions of SMEs regarding cloud computing use, focusing on cost reduction and impact on accounting applications. Findings: Cloud computing offers advantages, but cost reduction wasn't the primary motivator. Critique: Strengthening the study by increasing the sample size and including more variables would be beneficial. Understanding other motivating factors could provide a more comprehensive view. In a study conducted by Inggarsono et al. (2018), it was highlighted that an examination of the literature on cloud-based accounting applications reveals a crucial necessity for a comprehensive evaluation. The findings underscore a scarcity of systematic assessments in the current body of literature. While the study commendably advocates for considering factors such as compatibility, impact on organizational culture, and employee skills, it also suggests that the inclusion of more specific recommendations for future research would strengthen its overall contribution.

Dordevic (2018) underscored the benefits, challenges, and possibilities associated with cloud technology in the field of accounting, with a specific focus on Serbian companies. Results revealed a limited awareness and uptake of cloud technology, primarily attributed to apprehensions about security. However, it is suggested that the study could be enhanced by not only proposing training and awareness initiatives but also by exploring and addressing specific security issues along with potential solutions.

Study Abu Tarbush (2017) showcased cloud accounting as an emerging business model and explored its impact on the accounting process. The study revealed that concerns about compromised information acted as a deterrent to adoption. However, the critique notes a lack of specific recommendations despite suggesting strategies for software providers, and suggests that delving deeper into identified fears could enhance the study's depth.

On a related study, Weng et al. (2015) demonstrated the methods and advantages of implementing cloud computing in accounting information for Small and Medium Enterprises (SMEs) in China. The findings highlighted that cloud computing enhanced the security and reliability of accounting information for SMEs. Nevertheless, the critique points out that, while offering valuable insights into the benefits of cloud computing, the study's focus on China might limit its generalizability to a broader context.

In summary, this critical analysis presents a comprehensive overview of studies on cloud computing adoption among SMEs. To enhance clarity and coherence, consider incorporating brief summaries of key findings from the studies and providing more context where needed. Moreover, specific details about the benefits and security challenges of cloud computing would strengthen the analysis. Finally, offering concrete suggestions for future research would provide a clear direction for academics and practitioners interested in this area.

3. Model of the Study

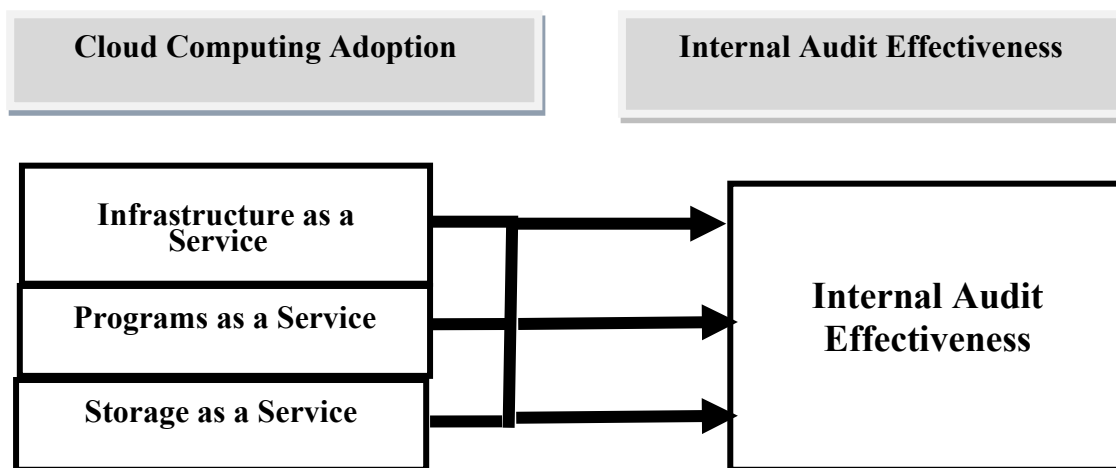


Fig.1: Model of the Study

Research hypothesis

H1: There is no statistically significant impact of cloud computing as an independent variable, represented by Infrastructure as a Service, programs as a service, and storage as a service, on the internal control system of Jordanian industrial companies

H101: There is no statistically significant impact of cloud computing, specifically within the dimension of Infrastructure as a Service, on the internal control systems of Jordanian industrial companies

H102: There is no statistically significant impact of cloud computing, specifically in the dimension of programs as a service, on the internal control system of Jordanian industrial companies

H103: There is no statistically significant impact of cloud computing, specifically with the dimension of storage as a service, on the internal control systems of Jordanian industrial companies

4. Research Methodology

Examining the Influence of Embracing Cloud Computing on the Efficiency of Internal Auditing is the central theme of this investigation. The research employs a descriptive research design rooted in quantitative research methodology. It is crucial to meticulously contemplate the research design of a project, as it shapes the methodologies and tools the researcher employs for data collection and analysis (Harris et al., 2019). In the context of this study, a random sampling approach was utilized.

4.1. Population and Sample

The population in the study, focused on managers employed in the fields of auditing and information technology within industrial companies situated in King Abdullah II Ibn Al-Hussein Industrial City, Jordan. The total population of interest encompassed (445) managers.

Sample size plays a crucial role in research, serving as a representative subset of the population to yield meaningful and statistically significant results (Sekaran & Bougie, 2010; Zikmund et al., 2012). Sampling is often preferred over collecting data from an entire population due to factors such as the population's size, resource constraints, and its ability to generate reliable and precise findings (Sekaran, 2006). Consequently, it is essential for the researcher to determine an appropriate sample size. The process of sampling typically involves three key steps: identifying the population, determining the sample size, and selecting the actual sample (Zikmund et al., 2010). For a population size of 445, the recommended sample size, according to Krejcie and (Morgan, 1970), is 260. In this study, a total of 260 questionnaires were distributed, with 235 being returned. Of these, 20 incomplete questionnaires were excluded from the analysis. As a result, the final dataset for analysis comprised (215) valid questionnaires.

4.2. Data Collection

The survey instrument, crafted in adherence to scientific principles and guided by prior research, functions as the principal tool for gathering data from the selected individuals. It consists of two sections: the initial section gauges the facets of Cloud Computing, while the second section appraises the dependent variable, Internal Audit Effectiveness.

The measurement scale was further subjected to validation through various phases, such as content and face validity, to ensure the clarity and comprehensibility of the items. This rigorous validation process was implemented to optimize efficiency and streamline the data collection process.

4.3. Data analysis

The data analysis for this study was conducted using (SPSS). 26 software. The primary functions performed in (SPSS) included descriptive statistical analysis, internal consistency reliability analysis for each variable, validity analysis, and correlation analysis between variables. Additionally, means and standard deviations were calculated for the responses of the individuals in the study sample. Furthermore, a multiple regression test, Simple regression test was conducted to examine the relationships between variables.

4.4. Reliability and Validity

To ascertain the validity of the instrument, it was presented to a group of specialized arbitrators who

made some modifications. An agreement percentage of 86% was reached among them, which is deemed suitable for the purposes of conducting this study. The reliability of the instrument was assessed by applying it to a pilot sample outside the original study sample. Subsequently, it was reapplied two weeks later. The reliability coefficient was calculated using the Cronbach alpha formula, resulting in a value of 89%, which is considered appropriate for the current study. Table (1) presents the reliability coefficients for the study variables.

Table 1: Cronbach's Alpha

Variables	Dimension	Cronbach's Alpha Value
Independent variable	Infrastructure as a Service	0.88
	Programs as a Service	0.89
	Storage as a Service	0.90
Dependent variable	Internal Audit Effectiveness	0.87
Total		0.89

These results, as documented by Njoroge, Bula, and Wanyoike in 2020, indicate that the questionnaire demonstrated strong internal consistency. All items achieved a coefficient value exceeding 0.7, aligning with the recommended threshold in the literature (Hair et al., 2012).

5. Results and discussion

To analyze the data, to explore the impact of Cloud Computing Adoption on Internal Audit Effectiveness from the employee's perspective in the Jordanian Industrial sector, the data was used as it shown as follow:

5.1. The Results of Analyzing the Means and standard deviations

To analyze the study variables, we calculated the means and standard deviations for the responses of the individuals in the study sample regarding the impact of items related to both cloud computing and the internal control system. The results are presented in Table 1, which displays the means and standard deviations for the study sample's responses to these items.

Table 2. Means and Standard Deviations for the Responses of the Individuals In the Study sample

Number	Items	Mean	S D
1.	Infrastructure as a service	3.863	0.91
2.	Programs as a service	3.766	0.86
3.	Storage as a service	3.802	1.18
Dependent variable			
4.	Internal audit	3.805	1.19

Table 2 reveals that the highest dimension is infrastructure, with a mean of 3.863, followed by storage as a service, with a mean of 3.802, and finally, programs as a service, with a mean of 3.766. The dependent variable, internal audit, has a mean of 3.805.

5.2. Testing the Research Hypothesis

To assess the research hypothesis, the researchers employed various statistical tests, with the following outcomes:

H1: There is no statistically significant impact of cloud computing as an independent variable, represented by Infrastructure as a Service, programs as a service, and storage as a service, on the internal control system of Jordanian industrial companies at $\alpha \leq 0.05$. To examine this hypothesis, a multiple regression test was conducted, as shown in Table 3.

Table 3. Multiple regression test to assess the impact of cloud computing on the internal control systems.

R ²	R	Sig. level	Tabulated (t)	Calculated (t)
0.237	0.485	0.009	1.98	3.19

The results in Table 3 reveal that the calculated (t) value is higher than the tabulated (t) value at the significance level ($\alpha \leq 0.05$). Accordingly, we reject the null hypothesis and accept the alternative hypothesis (H_A), stating that there is a statistically significant impact of cloud computing as an independent variable, represented by infrastructure as a service, programs as a service, and storage as a service, on the internal control system in Jordanian industrial companies at ($\alpha \leq 0.05$).

H101: There is no statistically significant impact of cloud computing, specifically within the dimension of Infrastructure as a Service, on the internal control systems of Jordanian industrial companies at ($\alpha \leq 0.05$). To test this hypothesis, Simple regression test was conducted, as presented in Table 3.

Table 4. Simple regression Test to Assess the Impact of Cloud Computing within the Infrastructure as a Service Dimension on the Internal Control System.

R ²	R	Sig. level	Tabulated (t)	Calculated (t)
0.291	0.54	0.000	1.96	.363

The results in Table 4 reveal that the calculated (t) value is higher than the tabulated (t) value at the significance level ($\alpha \leq 0.05$). Accordingly, we reject the null hypothesis and accept the alternative hypothesis (H_A), stating that there is a statistically significant impact of cloud computing as an independent variable, represented by Infrastructure as a Service, on the internal control system in Jordanian industrial companies at ($\alpha \leq 0.05$).

H102: There is no statistically significant impact of cloud computing, specifically in the dimension of programs as a service, on the internal control system of Jordanian industrial companies at ($\alpha \leq 0.05$). To test this hypothesis, simple regression test was employed, as demonstrated in Table 5.

Table 5. Simple regression Test to Assess the Impact of Cloud Computing in the Programs as a Service Dimension on the Internal Control System.

R ²	R	Sig. level	Tabulated (t)	Calculated (t)
0.27	0.52	0.042	1.96	.304

The results in Table 5 reveal that the calculated (t) value is higher than the tabulated (t) value at the significance level ($\alpha \leq 0.05$). Accordingly, we reject the null hypothesis and accept the alternative hypothesis (H_A), stating that there is a statistically significant impact of cloud computing as an independent variable represented by the dimension of Programs as a Service on the internal control system in Jordanian industrial companies at ($\alpha \leq 0.05$).

H103: There is no statistically significant impact of cloud computing, specifically with the dimension of storage as a service, on the internal control systems of Jordanian industrial companies at

($\alpha \leq 0.05$). To test this hypothesis, simple regression test was employed, as shown in Table 5.

Table 6. Simple regression Test to Assess the Impact of Cloud Computing in the storage as a service Dimension on the Internal Control System.

R ²	R	Sig. level	Tabulated (t)	Calculated (t)
0.31	0.175	0.017	1.96	2.40

The results in Table 6 reveal that the calculated (t) value is higher than the tabulated (t) value at the significance level (0.05). Accordingly, we reject the null hypothesis and accept the alternative hypothesis (H_A), which states that there is a statistically significant impact of cloud computing as an independent variable, represented by the dimension of storage as a service, on the internal control system in Jordanian industrial companies at ($\alpha \leq 0.05$).

The study aligns with Abd El Rahman and Alhelo's (2022) research on the influence of cloud computing on accounting information systems in service companies during the COVID-19 pandemic. Consistency in results regarding the favorable impact on efficiency, security, and dependability of accounting information systems indicates a degree of reliability in the findings. The current study expands the understanding derived from previous research by incorporating Jordanian industrial companies and focusing on internal control systems. This expansion provides a more comprehensive view of the influence of cloud computing within different organizational contexts, contributing to the generalizability of the findings.

Wahyuni's (2018) study on SMEs' intentions regarding cloud computing use is referenced, emphasizing the positive impact while suggesting a need for a more comprehensive investigation.

This reference adds relevance to the study by acknowledging potential limitations and advocating for future research improvements, such as increasing the sample size and exploring additional variables.

The study references Inggarsono et al.'s (2018) work to highlight a gap in the literature regarding comprehensive evaluations of cloud-based accounting applications. Acknowledging the scarcity of systematic assessments emphasizes the need for further research, indicating a potential avenue for future scholars to explore.

Dordevic's (2018) study on cloud technology in Serbian companies is mentioned to underscore potential benefits, challenges, and possibilities associated with cloud adoption in the accounting field. The mention of limited awareness and uptake due to security apprehensions highlights real-world challenges that organizations may face. The critique emphasizes the importance of increasing the sample size, exploring additional variables, proposing training and awareness initiatives, and addressing specific security concerns.

These suggestions provide constructive insights for enhancing the study's validity and applicability, indicating a pathway for future research improvements.

The findings contribute to existing literature by emphasizing the positive influence of cloud computing on internal control systems in Jordanian industrial companies. The incorporation of statistical significance adds robustness to the claims, enhancing the credibility of the study.

In conclusion, while the study aligns with prior research, it also introduces new dimensions to the understanding of cloud computing's impact on internal control systems. The identified gaps and suggestions for improvement provide valuable insights for researchers and practitioners in the field, encouraging further exploration and refinement of cloud adoption strategies in different organizational settings.

6. Conclusion

This study investigates the influence of Cloud Computing Adoption on Internal Audit Effectiveness in

Jordanian Industrial Companies. The findings reveal a positive and significant impact of Cloud Computing Adoption on Internal Audit Effectiveness within this context. Theoretically, this research stands out as one of the few studies addressing the relationship between Cloud Computing Adoption and Internal Audit Effectiveness, particularly in Jordanian Industrial Companies. Given the limited number of studies on this topic in Jordan, this research aims to bridge the existing gap.

From a practical perspective, the insights gained from this study hold significance for management in Jordanian Industrial Companies, especially in the current digital era characterized by dynamic environmental conditions. Cloud Computing Adoption is predicted to positively influence Internal Audit Effectiveness by leveraging digital technology advancements. The utilization of cloud computing contributes to enhancing Internal Audit Effectiveness and improving performance efficiency through integrated accounting systems. The flexibility and capabilities of cloud computing enable access to all accounting information processing requirements via the web within a streamlined system.

However, like any study, this research has its limitations. Firstly, the data is exclusively sourced from industrial firms in Jordan, limiting generalizability. Future research could broaden its scope to include companies in various sectors, both within and outside Jordan, with similar conditions. Secondly, there is an opportunity to explore additional variables related to Cloud Computing Adoption and their impact on Internal Audit Effectiveness. Thirdly, while this study employs a quantitative method, future research could consider incorporating qualitative methods for a more comprehensive analysis.

Based on the study results, it is recommended that Jordanian industrial firms embrace the latest advancements in cloud computing. Drawing insights and best practices from more advanced countries in the field can help these companies effectively integrate cloud computing solutions into their internal control systems. By doing so, they can enhance operational efficiency, adapt to evolving technological landscapes, and ultimately strengthen their long-term success and competitiveness.

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