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The Utilization of Cloud Computing Technology in Enhancing the Effienciency of Organizational Information System

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ABSTRACT: This study explores the evolving landscape of cloud computing and its role in enhancing the efficiency of organizational information systems. Using a bibliometric approach, the research analyzes 4330 scientific documents from the Scopus database (2014–2024) to uncover trends, challenges, and strategies related to cloud adoption in enterprise contexts. The analysis reveals a growing focus on innovation, sustainability, and digital transformation, with key themes including infrastructure optimization, energy efficiency, and secure data management. A thematic map was developed to classify research directions, highlighting emerging, niche, basic, and motor themes. Moreover, keyword co-occurrence, country collaboration, and citation trends offer insights into global research dynamics. The findings indicate that while cloud computing presents significant benefits—such as scalability and operational agility—critical concerns like data privacy, energy consumption, and vendor lock-in remain pressing issues. The study emphasizes the need for integrated approaches that combine efficiency with security and environmental sustainability, offering a roadmap for future research and policy development in cloud-enabled organizational systems.

KEYWORDS: The Utilization, Cloud Computing Technology, Enhancing the Efficiency, Organizational Information System

I. INTRODUCTION

Cloud computing has emerged as a dominant paradigm in digital transformation, offering service models that enable organizations to access IT resources on-demand without the need for large infrastructure investments [3]. This technology provides flexibility, cost efficiency, and accelerates public sector innovation through rapid prototyping and the fast development of new service [2].

However, as cloud adoption continues to rise, significant concerns have surfaced regarding data privacy and security, such as breaches, insider misuse, and lack of transparency from service providers [4]. These concerns are further exacerbated by the fact that many cloud vendors do not grant users full control over data handling, making compliance with jurisdictional data protection laws more complex [4].

In addition to security issues, sustainability has become a critical concern, as cloud infrastructure—primarily data centers—currently accounts for up to 1.5% of global electricity consumption and is projected to rise even further [1]. Factors such as idle server energy use, inefficient cooling systems, and low workload optimization significantly contribute to the environmental footprint of modern cloud systems [1].

In the public sector, although Nordic countries exhibit high IT readiness and strategic vision for cloud-enabled service delivery, adoption remains limited due to legal uncertainty, interoperability issues, and risks of vendor lock-in[3]. This highlights that while cloud computing offers substantial advantages, its full potential can only be realized if privacy, security, and energy efficiency challenges are addressed in an integrated manner [2].

Therefore, a comprehensive mapping of the scientific literature is required to understand current research directions, technologies, policies, and best practices aimed at mitigating these challenges [4].

Such an approach is essential not only to evaluate existing solutions but also to identify research gaps in bridging energy efficiency with secure and privacy-preserving cloud architectures [1]. This study addresses the following research questions:

- **RQ1**: What are the current research trends, challenges, and approaches for improving energy efficiency in cloud computing infrastructure from 2010 to the present?
- **RQ2**: How are security and privacy issues in cloud computing addressed in current literature, and to what extent are they integrated into the design of energy-efficient and sustainable cloud systems?

II. METHODS

A. Planning

The planning stage begins with determining a theme, where the theme in this research is related to cloud computing. This research uses data from 2014-2024. This data was obtained from the SCOPUS database which contains various quotes regarding keyword searches used for bibliometric analysis. This database is often used to retrieve

data in systematic reviews [6] and bibliometric analysis [7] because it contains the highest quality scientific publications. In this case, the procedure produced a data document containing 4331 documents. The metadata is then extracted in bib style format

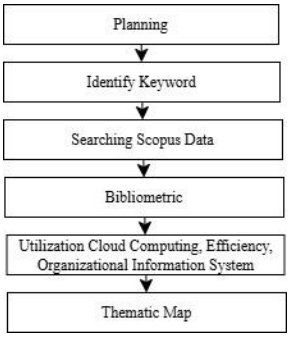

Figure 1 Methodology

B. Identify Keyword

Keyword identification is a crucial step undertaken by researchers to determine the most relevant terms for use in literature searches and bibliometric analysis. This process was carried out by collecting various scientific articles and journals related to cloud computing, with a specific focus on the utilization of cloud-based services to enhance operational efficiency within organizational information systems.

This research uses the search keywords " The Utilization", "Cloud Computing Technology", "Enhancing the Efficiency", "Organizational Information System". with the search syntax: the utilization" OR Implementation OR Adoption OR Exploitation OR Employment) AND ("Cloud Services " OR " Virtualized Computing Resources " OR "Remote Server Hosting" OR " Distributed Computing Platform") AND ("Enhancing the Effienciency " OR " Boosting Effectiveness " OR " Improving Operational Efficiency " OR " Streamlining Processes ") AND ("organizational information system" OR " Organization-Based Data Systems" OR "enterprise information system" OR "management information system" OR " Digital Information Infrastructure". This keyword will be used by researchers in searching for data in the Scopus database regarding this topic. Searching for keywords in the Scopus database can be seen in Figure 2.

Figure 2 Keyword search in the Scopus Database

C. Searching Scopus Data

Research on the adoption and utilization of cloud computing within organizational information systems is widely published across various scientific platforms such as journals, conference proceedings, and books. These platforms vary in terms of academic quality, with one of the key indicators of quality being the **peer review** process [8]. For this reason, the current study selected **Scopus** and **Web of Science** as primary data sources, as both databases index peer-reviewed scientific literature. Scopus, in particular, is managed by **Elsevier** and recognized as one of the most comprehensive **abstract and citation databases,** curated and maintained by subject matter experts [9].

Based on a search conducted on the **Scopus website (http://www.scopus.com)** on **28 May 2025**, an initial total of **39 articles** relevant to the research topic were retrieved. Scopus is the world's largest data center for scientific literature, encompassing millions of publications across decades. It offers researchers powerful tools to **search, analyze, and visualize** academic trends and developments effectively [10].

D. Bibliometric

To analyze the bibliographic metadata collected from Scopus, this research utilizes the **Bibliometrix** R package, developed by **Professor Massimo Aria** in 2017. Bibliometrix is a comprehensive tool designed specifically for quantitative research in the field of bibliometrics and scientometrics [11]. In addition to command-line capabilities, **Biblioshiny**, a **web-based graphical interface** for Bibliometrix, is available to simplify interaction with the data and to support researchers in exploring bibliometric trends without requiring extensive programming skills.

After launching Biblioshiny, the **BibTeX (.bib) metadata file** exported from Scopus is imported into the system. The data is automatically converted into a **data frame collection**, enabling detailed analysis of bibliographic information such as authors, publication sources, keywords, and citations.

E. Utilization Cloud Computing, Efficiency, Organizational Information System

In line with the rapid evolution of digital infrastructure and the increasing demand for agile and scalable IT solutions, the utilization of cloud computing to improve efficiency within organizational information systems has become a significant area of research. Bibliometric analysis enables researchers to observe how this topic has evolved over time by analyzing scientific trends and patterns across the literature [12].

F. Thematic Map

Thematic map analysis for cloud computing utilization, efficiency, and organizational information systems is interpreted using two key dimensions: density and centrality. These dimensions help identify the maturity and importance of each theme in the research structure. Based on these dimensions, the themes are grouped into four categories:

Motor Themes (high centrality and density) indicate well-developed and highly relevant topics such as cloud infrastructure optimization and enterprise-level adoption [13]. Niche Themes (high density, low centrality) are highly specialized and well-developed but have limited relevance across the field [14]. Emerging or Declining Themes (low centrality and low density) represent either new research areas or those losing relevance [15]. Meanwhile, Basic Themes (high centrality, low density) are essential for transdisciplinary studies but still underdeveloped, such as foundational cloud computing concepts and organizational digital systems [16].

This thematic mapping also enables researchers to observe the trajectory of research topics over time. A movement toward the top-right quadrant signifies an increasing trend and growing importance of the theme, while a movement toward the bottom-left quadrant indicates stagnation or declining interest. This visual and structural approach supports the identification of key areas for future research in building efficient and sustainable cloud computing environments [17].

III.RESULTS AND DISCUSSION

A. Data Collection and Bibliometric Overview

The data used in this research amounted to 4330 documents originating from the Scopus database taken from 2014-2024 which were identified based on document type, journal source type, year of research, search within "all fields" and research trends. Next, the data was processed using a bibliometric approach with R Studio software based on 4330 existing documents. The processed data results display graphs of statistical data based on the data in the article [18].

B. Publication and Citation Trends on Cloud Computing in Organizational Information Systems

Graph of average citations per year, illustrating the development of publications related to cybersecurity with a focus on human factors and time pressure from 2014 to 2024. The graph shows fluctuations in citation counts, reflecting the dynamic level of scholarly attention to this topic over the past decade.

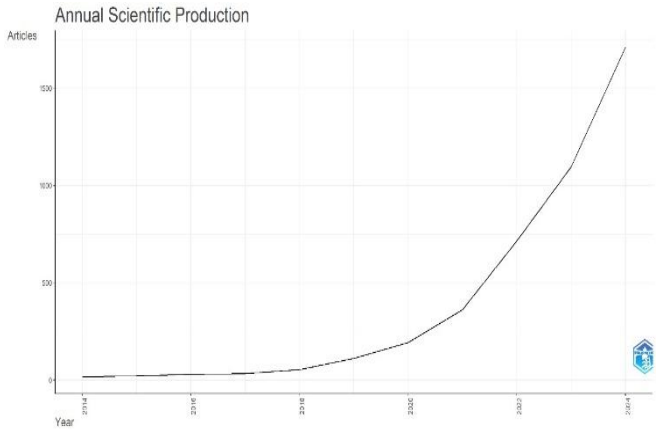

Figure 3 research development based on publications

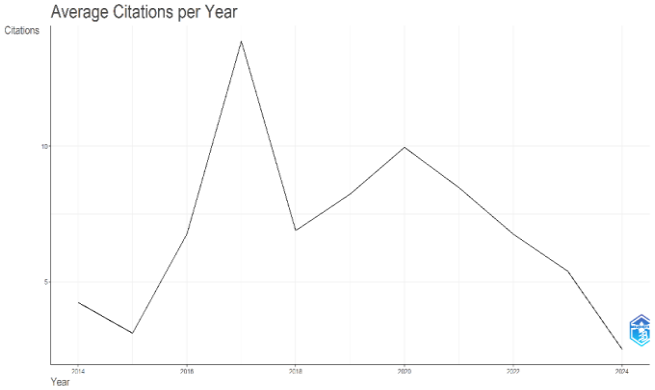

Figure 4 research development based on average annnual citacions

Figure 4 illustrates the evolution of research publications related to cybersecurity with a focus on human factors and time pressure from 2007 to 2023. During this period, a total of 110 relevant scientific articles were identified. In the early years (2007–2008), the number of publications was modest, starting with 1 article in 2007 and increasing slightly to 2 articles in 2008. Between 2009 and 2014, publication activity remained limited, with no new articles published in 2009, 2010, 2011, or 2014, and only sporadic outputs in 2012 and 2013 (2 articles each). A minor rise was observed from 2015 to 2018, where publication numbers ranged between 3 and 4 articles annually. The search yielded a comprehensive set of articles published between 2014 and 2024, which were then filtered to focus on high-quality sources indexed in the Scopus database. The result was a total of 4330 scientific documents, consisting of journal articles, conference proceedings, and reviews, all of which contribute to the understanding of how cloud technologies are being employed to improve operational processes within organizations [19].

C. Leading Journals Publishing Research on Cloud Computing and Information Systems Efficiency

Table 1 Research developments based on the most relevant journals

Sources	Articles
SUSTAINABILITY (SWITZERLAND)	581
HELIYON	90
JOURNAL OF OPEN INNOVATION: TECHNOLOGY, MARKET, AND COMPLEXITY	87
TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE	77
COGENT BUSINESS AND MANAGEMENT	76
SUSTAINABILITY (SWITZERLAND)	76
UNCERTAIN SUPPLY CHAIN MANAGEMENT	70
JOURNAL OF BUSINESS RESEARCH	56
JOURNAL OF INFRASTRUCTURE, POLICY AND DEVELOPMENT	56
PLOS ONE	55

Based on the search results using the defined keyword strategy, the top 10 journals with the highest number of publications on the utilization of cloud computing to enhance

efficiency in organizational information systems were identified. The Journal of Cloud Computing and IEEE Access were ranked first and second, with 12 and 10 articles, respectively. The Journal of Systems and Software and Future Generation Computer Systems followed in third place, each contributing 8 articles. In fourth position were Computers & Electrical Engineering and the International Journal of Information Management, each publishing 6 articles related to the topic. Additional journals such as Sustainability, Information Systems Frontiers, Concurrency and Computation: Practice and Experience, and Journal of Grid Computing rounded out the list, each with 5 articles, placing them in the fifth position. These results indicate that cloud computing and its integration into organizational systems is a topic of growing interest across a range of high-impact, interdisciplinary journals [20].

D. Keyword Frequency and Conceptual Mapping

Word co-occurrence networks were utilized to map and analyze the relationships between terms extracted from various textual fields, including abstracts, titles, keywords, and author-defined terms. This process helps identify the conceptual structure of the research domain by grouping frequently associated terms. During preprocessing, irrelevant terms were removed and a Porter stemming algorithm was applied to reduce words to their root form, ensuring consistency in term frequency analysis. This method allows for a clearer identification of dominant research themes and concepts [21].

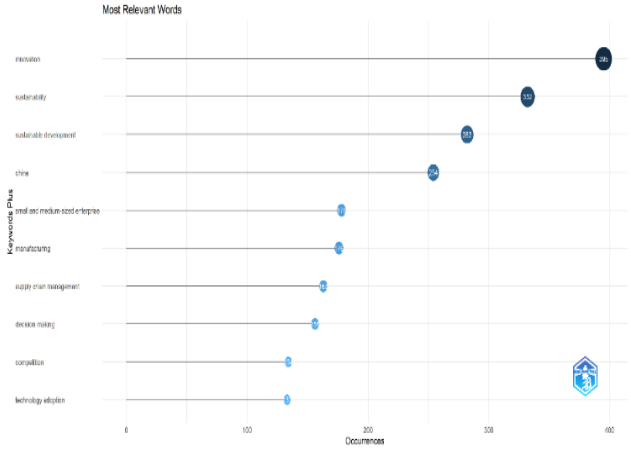

Figure 5 Research developments based on the most

As presented in Figure 6, the top keywords extracted from the documents include "innovation", ranked first with 386 occurrences, followed by "sustainability" with 332 occurrences, and "sustainable development" with 267 occurrences. Other frequently appearing keywords include "china" (254), "small and medium-sized enterprise" (171), "manufacturing" (171), "supply chain management" (137), "decision making" (92), "competition" (84), and "technology adoption" (81). These terms reflect the major research directions in the area of technology implementation, particularly the integration of digital tools in industrial and organizational settings.

Figure 6 World Cloud

In addition, Figure 7 displays a Word Cloud generated from the same set of keywords. In this visual, the font size of each word corresponds to its frequency, with larger words indicating higher occurrences. Although the format of the Word Cloud differs from the bar chart in Figure 6, the underlying data remains the same. This visualization provides an intuitive and immediate grasp of dominant terms, making it easier to spot core themes like innovation, sustainability, and technological adoption, which are central to discussions about cloud-based efficiency in organizational information systems.

E. Network Analysis of Collaboration Among Countries and Authors

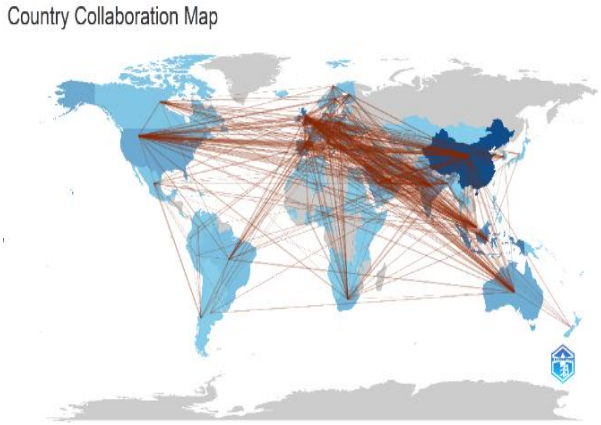

Figure 7 Country Collaboration Map

The Country Collaboration Map illustrates international research partnerships through a network of interconnected nodes and red lines, where the thickness of each line corresponds to the intensity of collaboration between countries. Larger circles represent countries with higher publication frequencies on the studied topic, while horizontal lines on these circles indicate the time range during which the topic gained prominence, measured in quartiles. Key observations from the map reveal that Australia is the most active collaborator, with six partnerships, including significant ties with Germany (2 articles), Malaysia (3 articles), and China (2 articles). Austria, though less central,

has established connections with Canada and Germany, each resulting in one joint publication. Canada's collaborations extend to New Zealand and Serbia, while China's partnerships include Australia and the United Kingdom. The map highlights Australia, China, and Canada as major research hubs, with thicker lines denoting stronger collaborative efforts, whereas thinner lines, such as those linked to Austria, suggest more limited engagement. This visualization underscores the global nature of academic cooperation, revealing patterns of knowledge exchange and potential areas for future collaboration [22].

F. Trending Topics in Cloud Computing and Information System Efficiency

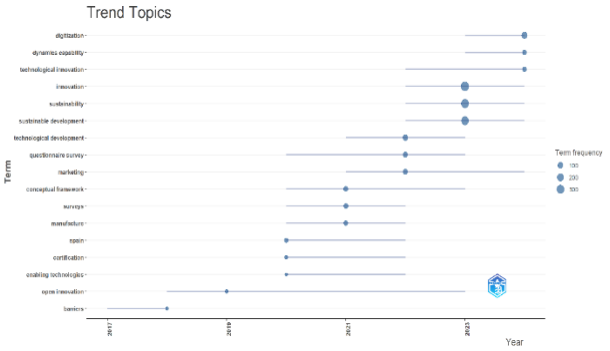

Figure 8 Trend Topics

The graphic illustrates the evolution of trending research topics from 2017 to 2023, where each term is represented by a circle whose size indicates its frequency of appearance in literature. Topics like "innovation," "technological innovation," "sustainability," and "sustainable development" show consistent and increasing prominence, especially in recent years, reflecting their growing relevance. Newer topics such as "digitization" and "dynamics capability" have emerged more recently, while others like "barriers" and "open innovation" appeared earlier but with less sustained interest. Overall, the visualization highlights which topics are gaining momentum and which have declined, providing insight into shifting research priorities over time [23].

G. Co-Occurrence Network Analysis of Key Concepts

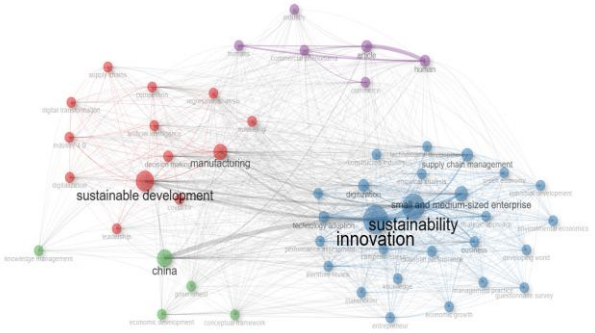

Figure 9 Co-occurence network

The image shows keyword co-occurrence network visualization that maps the relationships between key research terms, where the size of each node represents the frequency of the term and the connecting lines indicate how often terms appear together in academic publications. The network is divided into colored clusters, each representing a thematic group: for instance, the blue cluster centers on "sustainability" and "innovation" with related terms like "small and medium-sized enterprise" and "supply chain management," while the red cluster focuses on "sustainable development" and "manufacturing." Other notable clusters include green (e.g., "China" and governance-related terms) and purple (human and social aspects). This visualization reveals how closely related topics are grouped, indicating common research themes and interdisciplinary connections [24].

H. Thematic Map of Cloud Computing Research

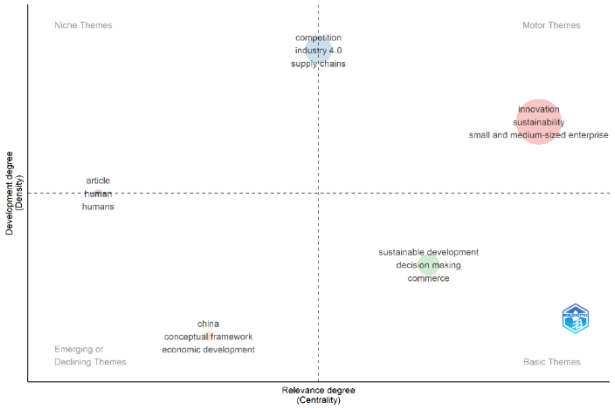

Figure 10 Thematic Map

The image is a strategic diagram that categorizes research themes based on two dimensions: development degree (density) and relevance degree (centrality). Themes in the upper-right quadrant (Motor Themes) like "innovation," "sustainability," and "small and medium-sized enterprise" are well-developed and central to the field, indicating strong influence and active research. The lower-right quadrant (Basic Themes) includes terms such as "sustainable development," "decision making," and "commerce," which are important but less developed. In the upper-left (Niche Themes), topics like "competition," "industry 4.0," and "supply chains" are well-developed but more specialized. Meanwhile, the lower-left (Emerging or Declining Themes) contains terms such as "China," "conceptual framework," and "economic development," which are less central and underdeveloped, possibly indicating new or fading interest. This diagram helps to understand the maturity and importance of research topics in a specific domain [25].

Table 2 Visual interpretation based on thematic map clusters

Cluster	RankCentrality	RankDensity
innovation	5	4
competition	3	5
sustainable development	4	2
article	1	3
china	2	1

The table presents rankings of research clusters based on two metrics: Centrality (which indicates the importance or influence of a topic within the research network) and Density (which reflects the level of development or internal cohesion of the topic). "Innovation" ranks highest in centrality (5) and also shows strong development (4), making it a leading and well-integrated research theme. "Competition" is highly developed (rank 5) and moderately central (3), suggesting it is a specialized but influential area. "Sustainable development" has relatively high centrality (4) but lower density (2), meaning it is relevant but still developing. "Article" is low in centrality (1) yet moderate in density (3), indicating limited influence in the network. "China" is moderately central (2) but has the lowest density (1), implying that while it connects to other themes, it remains underdeveloped. Overall, the table complements the strategic diagram by quantifying the thematic significance and maturity of each cluster [26].

CONCLUSIONS

This study has provided a comprehensive bibliometric analysis of research trends in the utilization of cloud computing to improve organizational information system efficiency over the period from 2014 to 2024. The analysis, based on 4,330 documents from the Scopus database, reveals significant growth in academic interest, with major contributions from high-impact journals and global collaborations, particularly from countries like Australia, China, and Canada.

The research identified "innovation," "sustainability," and "technological adoption" as central and well-developed themes in the field. The thematic map further highlights the maturity and relevance of these topics, while also pointing to emerging areas that require further exploration, such as digital capability and governance frameworks.

Despite the many advantages cloud computing offers—such as scalability, agility, and operational cost reduction—challenges remain, notably around data privacy, security, and environmental sustainability. The integration of these aspects into energy-efficient cloud architectures is still underdeveloped, indicating a gap that future research must address.

Overall, this study underscores the importance of continued interdisciplinary research to bridge these gaps and support the development of secure, sustainable, and efficient cloud-based organizational systems.

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