Review

Evaluating the Impact of Cloud Computing on SMEs Performance: A Systematic Review

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Evaluating the Impact of Cloud Computing on SMEs Performance: A Systematic Review

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Abstract: In recent times, the adoption of cloud computing by small and medium-sized enterprises (SMEs) has become a crucial issue. These businesses face substantial difficulties in accessing reliable and affordable IT infrastructure due to economic constraints and technological restrictions. Hybrid cloud computing solutions which incorporate Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS) offer a feasible approach to overcoming these challenges. This study proposes a systematic literature review of cloud computing's impact on SME performance emphasizing cost-efficiency, reliability, and competitive advantages, using the 2020 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework. The inclusion criteria are bounded by (1) publication date between 2014 and 2024, (2) English-language publications, (3) research focused on cloud computing for SMEs, and (4) studies with a clear analytical framework for evaluating SME performance. Following this process, 90 eligible research studies were included. The average total cost for cloud services varies significantly, with operational costs reflecting the scalability of the services and the specific needs of SMEs. This analysis offers valuable guidance for SMEs and stakeholders in optimizing cloud-based strategies for enhanced performance.

Keywords: cloud computing; infrastructure as a service (IaaS); platform as a service (PaaS); software as a service (SaaS); SME performance; systematic review

1. Introduction

Cloud computing (CC) has rapidly advanced as a crucial element in the technological landscape, offering businesses exceptional flexibility and scalability in managing their Information technology (IT) resources [1]. This technology allows organizations access to a range of services, such as storage, processing power, and software applications, over the Internet, which can be utilized on a pay-as-you-go basis. This model has proven to be particularly beneficial for small and medium-sized enterprises (SMEs), which often face major challenges in terms of resource constraints and the high costs associated with traditional IT infrastructure [2–5]. Despite the well-defined advantages, the adoption of cloud computing in SMEs, more especially in developing countries, has been slower than expected. This hesitation can be attributed to various technological, organizational, and environmental factors that influence decision-making within these businesses [6,7]. Key factors include concerns over the complexity and security of cloud services, the level of support from top management, prior experience with IT, and external elements such as regulatory frameworks and infrastructure availability [8]. This systematic review aims to identify the critical forecasts of cloud computing adoption and to assess the impact of this adoption on SME's performance. The research explicitly examines the roles of factors such as relative advantage, service quality, perceived risks, top management support, facilitating conditions, cloud provider influence, server location, computer self-efficacy, and resistance to change in determining the likelihood of cloud computing adoption. To achieve this, a dual-stage analytical approach combining Structural Equation Modelling (SEM) and Artificial Neural Networks (ANN) was employed, providing a comprehensive analysis of these factors and their effects on SME performance [9,10].

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The findings from SEM indicate that relative advantage, service quality, and perceived risks significantly influence cloud computing adoption. The study also emphasizes the importance of managerial support and the impact of external factors like cloud provider influence and server location. Additionally, ANN analysis identifies server location as the most critical predictor of cloud adoption, followed by facilitating conditions, relative advantage, and service quality [11]. These insights suggest that SMEs must consider both internal and external factors carefully when adopting cloud computing technologies [12,13]. The implications of cloud computing adoption for SME performance are significant. The study confirms that cloud computing adoption positively impacts firm performance by enhancing operational efficiency, scalability, and competitiveness. The Importance-Performance Map Analysis (IPMA) results recommend that managerial actions should focus on improving perceived risks, relative advantage, and top management support to maximize the benefits of cloud adoption [14–16]. This research contributes to the existing body of knowledge by offering a delicate understanding of the factors controlling cloud technology adoption in SMEs and by providing useful insights for researchers, business managers, policymakers, and cloud service providers [17–19]. By addressing the challenges and opportunities associated with cloud computing adoption, this study aims to support technological innovation and business growth in the SME sector, particularly in developing economies [20].

The reviewed literature in Table 1 reveals several significant research gaps in the study of cloud computing adoption among SMEs. Firstly, several studies have a restricted focus, primarily emphasizing risk factors without thoroughly exploring other crucial aspects such as cost, security, and organizational perspectives. This narrow scope restricts a holistic understanding of cloud adoption. Moreover, numerous studies are constrained by geographic limitations, concentrating on specific regions or countries, which hinders the generalizability of their findings to a broader global context. Additionally, some research tends to focus closely on specific adoption factors, such as scalability, cost savings, or infrastructure, without integrating these with other essential considerations like ease of use and management support. The lack of practical validation in certain studies also poses a challenge, as proposed models or identified factors may not be fully applicable in real-world scenarios where SMEs face diverse challenges. Another notable gap is the insufficient attention given to post-adoption issues; while adoption challenges are often discussed, the long-term impacts and ongoing challenges faced by SMEs after implementing cloud solutions are frequently overlooked.

Table 1. Comparative analysis of the existing review works and proposed systematic review on the impact of cloud computing on SMEs performance.

Ref.	Cites	Year	Contribution	Pros	Cons
[21]	35	2014	Reviews cloud computing endorsement in SMEs, highlighting key risks and issues.	Exhaustive review concentrating on the risk analysis.	Restricted research of non-risk factors of adoption of cloud computing on SMEs.
[22]	25	2014	Evaluate cloud adoption in SMEs, emphasizing operational, technical, and organizational gaps.	Determine key endorsement factors; extensive literature review.	Limited by geography, scope; SME adoption model coverage and lacks institutional theory.
[23]	18	2015	Provides a systematic review of cloud computing adoption in SMEs, focusing on risk analysis and proposing a future research agenda.	Offers a structured literature overview, emphasizes critical risk issues, and provides clear future research directions.	Limited to articles up to 2016, focuses primarily on risk analysis, and may introduce subjective bias and limited scope.
[24]	53	2015	Reviews factors affecting cloud computing adoption and suggests a hypothetical model.	Specify key factors viz. management support, cost, ease of use, security, and usefulness.	Lacks practical validation, and limited focus on technical aspects.

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[25]	20	2015	Evaluate cloud computing adoption in SMEs, highlighting adoption issues and future research on post-adoption impacts.	Determines research gaps and proposes to focus on the performance of SMEs.	Restricted focus on post-adoption problems.
[26]	21	2016	Risk assessment in cloud computing adoption.	Addresses crucial risk factors, improving decision-making for the adoption of cloud.	Lacks organizational perspective; restricted to technical issues.
[27]	91	2016	Factors affecting SME processes in cloud computing.	Emphasizes scalability as a key factor, providing a foundation for future performance.	Focuses on cloud adoption without integrating other crucial adoption factors like cost and security.
[28]	49	2016	Review on C-KMS in processes of SME KM.	Demonstrate a detailed review of recent developments.	Focuses on databases less KM processes.
[29]	36	2017	Privacy, trust, and security in cloud computing.	Extensive analysis of key concerns of cloud computing.	Focusing more on technical issues, and less on a holistic approach to adoption factors.
[30]	3	2017	Review of types of cloud computing supporting SMEs.	Furnish a list of solutions of cloud for SMEs.	Restricted to 12 articles, specific focus.
[31]	0	2017	Examines adoption of cloud computing among SMEs.	Emphasizes benefits like scalability and efficiency.	Limited focus on integration and security.
[32]	7	2017	Reviews factors affecting successful cloud computing in SMEs.	Emphasizes benefits like flexibility and efficiency.	Limited focus on precise difficulties.
[33]	1	2018	Classifies barriers to cloud computing.	Insights review using PRISMA, several databases.	Limited infrastructure issues and awareness.
[34]	230	2018	Reviews challenges, gaps, and advances in cloud computing.	A thorough review of current developments.	Limited to security and privacy.
[35]	1	2020	Examine HPC SME cloud contracts.	Furnish guidelines and guidance for contract management and negotiation.	Narrows topic with restricted extensive applicability.
[36]	4	2020	Review cloud computing in developing countries.	Determine key endorsement factors and specific advantages to developing countries.	Limited to developing countries.
[37]	0	2020	Carry out SLR and bibliometric review on IT adoption.	Highlights crucial improvement in publications.	May lack detailed IT implementation.
[38]	50	2020	Offers a systematic literature review on cybersecurity risk management in SMEs.	Highlights major perspectives in cybersecurity risk management using NVivo software.	Limited to 15 out of 50 papers, may not capture all relevant studies.
[39]	17	2021	Explains SMEs' benefits from cloud computing and key adoption factors	Identifies cost-effectiveness, flexibility, and scalability as primary benefits of cloud computing for SMEs.	Relies on a small sample size of six SMEs.
[40]	36	2022	Explores Indonesian SMEs' views on cloud computing benefits, challenges, and business impact.	Highlights cloud computing benefits for SMEs.	Points out concerns over security and limited infrastructure.
[41]	7	2022	Examines Indonesian SMEs' views on cloud computing benefits.	Highlights cost savings and improved communication as key benefits of cloud computing for SMEs.	Limited to security and infrastructure.

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[42]	108	2023	Evaluate cloud computing suitability for Indian SMEs using a tested conceptual framework.	Highlights cost savings, scalability, and improved disaster recovery for SMEs.	Focus on only 121 manufacturing SMEs, which may limit generalizability.
[43]	42	2024	Identifies key factors in Pakistani SMEs' cloud adoption using the TEO framework.	Highlights six positive factors and validates them with robust statistical methods.	Relies on data from a limited sample of 103 SMEs.
[44]	162	2024	Reviews cloud computing adoption issues, classifies key factors and suggests a research agenda.	Identifies major adoption challenges and offers a future research agenda for cloud computing adoption.	May not cover all recent developments or emerging trends in cloud computing.
Proposed systematic review			Evaluates the impact of cloud computing on SME performance, highlighting key benefits such as cost savings, scalability, and enhanced operational efficiency. Examining factors influencing cloud adoption.	Offers a comprehensive understanding by identifying critical predictors of cloud adoption and assessing their impact. The review highlights research gaps and provides valuable guidance for researchers to enhance cloud adoption in SMEs.	-

1.1. Research Questions

Though numerous studies on the evaluation of cloud computing on SMEs have been conducted worldwide in the last decade, there are limited comparative studies on the impact of cloud computing on SME's performance in the literature. Therefore, this work proposes to review the available literature on the evaluation of these impacts. The goal is to provide a comprehensive analysis of the impact associated with cloud computing on SME performance. To attain the goal and objectives of this research, the authors considered the undermentioned research questions:

- Why should SMEs make use of cloud computing to perform their business functions?
- What potential and future expectations do cloud computing services present on SMEs?
- What is the impact of utilizing cloud computing services on the business performance of SMEs?
- What are the costs involved in using cloud computing technology and how does it affect a company's budget?
- What business operations are affected by the adaptation of cloud computing and what are the most impacted business operations?

1.2. Rationale

The existing literature presented insights on technical and organizational aspects of cloud computing adoption in SMEs. However, there is a lack of exhaustive review of how these technologies affect the performance of SMEs over the long term. Furthermore, depending on various sectors and regions the benefits of cloud computing may vary, which adds to the complexity of this issue. Cloud computing has advanced rapidly and is transforming the technology world and it offers advantages like scalability, flexibility, and cost-effectiveness which are very appealing to SMEs. Although the adoption of cloud computing is increasing in SMEs, there is still a lack of broad understanding concerning the impact of cloud computing on overall performance.

This systematic review aims to produce a set of knowledge on the existing impact of cloud computing on SME performance. This review will pinpoint the trends, opportunities, and challenges associated with the adoption of cloud computing among SMEs by significantly examining different existing studies. The results of this review will deliver valued insights to business managers and researchers.

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1.3. Objectives

Cloud computing has developed as a changing technology for SMEs, offering several benefits such as scalability, cost efficiency, and advanced business processes. However, the degree to which SMEs are influenced by these advantages and limitations on their comprehensive performance remain crucial areas for exploration. This systematic review aims to explore the multifarious relationship between SMEs' operational performance and the adoption of cloud computing. By evaluating many dimensions like financial outcome, operational performance, efficiency, innovation capability, and long-term growth this research intends to furnish a thorough insight into how SMEs are influenced by cloud computing. Therefore, the precise objectives of this research are:

- To assess the embracement rate of cloud computing among SMEs.
- Understanding how extensive cloud computing is among the SME sectors as well as the factors affecting adoption rate.
- Analyzing the influence of cloud computing on the operating performance of SMEs, examining how it impacts scalability, efficiency, and business processes.
- Determining financial performance advancements in SMEs due to the adoption of cloud computing.
- Evaluating cloud computing's role in improving innovation and competitive advantage of SMEs.
- Identifying barriers and difficulties faced by SMEs in implementing and adopting cloud computing solutions.
- Exploring the long-term impact of cloud computing among SMEs.

1.4. Research Contribution

This work introduces a detailed systematic survey of the impact of cloud computing on SMEs' performance. We spotlight various pending issues and research challenges in the adoption and deployment of cloud computing by SMEs. The research contributions made by the proposed work are as follows:

- We furnish a thorough analysis of cloud computing, centring on the integration of cloud services, data storage, and computing power. This analysis underscores the cost-effectiveness, reliability, and scalability benefits of cloud computing, offering crucial insights for informed decision-making and promoting the adoption of these technologies among SMEs.
- We consolidate existing research on cloud computing and identify gaps in the literature, particularly regarding the successful adoption and integration of cloud services by various SMEs. By addressing these gaps, we highlight areas needing further research and innovation, thereby advancing the field of cloud computing and ensuring improved performance and competitiveness of SMEs.

1.5. Research Novelty

The proposed work has the following novelty. According to the best knowledge of the authors, there is no existing similar study in the literature that introduces a systematic evaluation of the impact of cloud computing on SMEs' performance, exclusively focusing on the integration of cloud services into small and medium enterprises. We provide a comprehensive evaluation of cloud computing's impact, focusing on data storage, computing power, service scalability, and their applications across diverse SMEs.

2. Materials and Methods

In this section, based on Figure 1 the research presents the methodology to establish the proposed systematic survey based on the Impact of Cloud Computing on SME performance. The research is based on a 10-year review (2014-2024).

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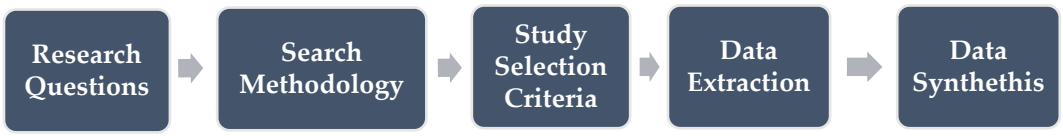

Figure 1. SLR Flow Diagram.

2.1. Eligibility Criteria

A systematic study of all peer-reviewed and published research works relevant to the evaluation of the impact of cloud computing on SMEs was conducted for examination. The research works published in the English language on the functions, strengths, weaknesses, and cost considerations of these technologies during the last decade from 2014 to 2024 were considered. A proper inclusion criterion was adopted to incorporate appropriate research papers and exclude those that did not focus on the comprehensive evaluation of cloud computing. Consequently, only peer-reviewed research works that fundamentally converge on the functional, performance, benefits, and challenges of this technology were exclusively considered. The inclusion and exclusion criteria for this study are tabulated in Table 2.

Table 2. Proposed Inclusion and Exclusion Criteria.

Criteria	Inclusion	Exclusion
Topic	Articles focusing on Evaluating the Impact of Cloud Computing on SME's Performance	Articles not related to Evaluating the Impact of Cloud Computing on SME's Performance
Research Framework	This article must include a research framework or methodology for Evaluating the Impact of Cloud Computing on SME's Performance	Articles lacking a clear research framework related to Evaluating the Impact of Cloud Computing on SME's Performance
Language	Must be written in English	Articles published in languages other than English
Period	Articles between 2014 and 2024	Articles outside 2014 and 2024

2.2. Information Sources

The reviewed literature was collected from reliable online research repositories. An exhaustive search was carried out on scholarly work published on the following online repositories: Google Scholar (GS), Scopus, and Web of Science. Multifaceted accessible research papers were also observed for their research title, abstract, and search tags and were utilized to carry out additional search terms to pursue published material including journal articles, conference papers, book chapters, dissertations, and master thesis.

2.3. Search Strategy

To obtain the applicable and relevant literature, it is crucial to have a set of keywords related to the systematic review topic. The keyword search assists in reducing irrelevant literature while maximizing the results of studies related to evaluating the impact of cloud computing on SME performance. The synonyms developed for the term “cloud computing” included "cloud technology”, “cloud services”, “cloud adoption” and “cloud-based solutions”. For the term “SMEs” the following synonyms were adopted “small and medium enterprises”, “small businesses”, “medium enterprises” and “SMBs”. The alternate terms for “performance” that were employed for the keyword search included “Business performance”, “operational performance”, “financial performance”, “efficiency”, “productivity” and “growth”. The search strategy also made use of the logic operators “AND” and “OR” to pinpoint relevant studies. The keyword search utilized for this research is ("Cloud Computing" OR "Cloud Technology" OR "Cloud Services" OR "Cloud Adoption"

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OR "Cloud-Based Solutions") AND ("SMEs" OR "Small and Medium Enterprises" OR "Small Businesses" OR "Medium Enterprises" OR "SMBs") AND ("Performance" OR "Business Performance" OR "Operational Performance" OR "Financial Performance" OR "Efficiency" OR "Productivity" OR "Growth"). This keyword search yielded a total of 18 570 papers from all the online repositories after customizing the range from 2014 to 2024 as mentioned in the inclusion and exclusion criteria. The list of online repositories that were employed as well as the total number of results attained before screening is tabulated in Table 3.

Table 3. Results obtained from Literature Search.

No.	Online Repository	Number of results
1	Google Scholar	18 100
2	Web of Science	165
3	Scopus	305
Total		18 570

2.4. Selection Process

This section outlines the procedure utilized for screening and evaluating research papers incorporated in this study as presented in Figure 2. It describes the systematic process utilized to ensure consistent and thorough assessment, including the roles of individual researchers and the procedures for resolving disputes. Exhaustive steps are presented on how titles, abstracts, and full-text journals were reviewed, to reach consent and address challenges. This approach aimed to sustain high standards of objectivity throughout the selection process.

Four researchers (AM, KDM, MT, BAT) individually evaluated titles and abstracts of the first 90 papers and discussed contradictions up until consent was achieved. Then, in pairs, the researchers individually screened titles and abstracts of all journals extracted. In case of disputes, consent on which journals to screen full text was achieved by discussion. If required, the 4th researcher was consulted to make the final decision. Then, three researchers (AM, KDM, MT) individually screened full-text journals for inclusion. Moreover, consensus was achieved on exclusion or inclusion by discussion and if required, the fourth researcher (BAT) was consulted, in case of disagreements.

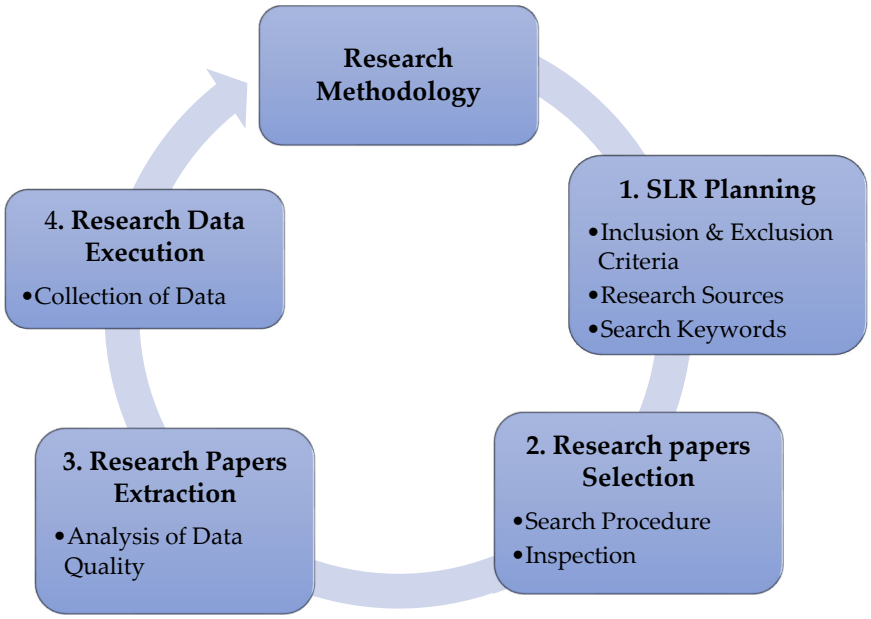

Figure 2. Procedures and Stages of the Review.

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2.5. Data Collection Process

This section outlines the methods used for collecting data from the included reports, detailing the roles of the reviewers, the procedures for independent data extraction, and any techniques used to verify and confirm the accuracy of the data as presented in Figure 3.

The research was conducted with the data collected from publications on SMEs. This systematic review was administered among SMEs located in different countries. The data extraction method used is similar to the one used in [45]. Data were collected from the reports of included studies using a structured data extraction form customized for this review. Three independent reviewers/authors performed the data extraction procedure. Each reviewer individually extracted data from all suitable studies. To ensure consistency and accuracy, the obtained data were then compared between the three reviewers/authors. Any inconsistencies identified during this comparison were resolved through discussion, and where necessary, a fourth reviewer was consulted to reach a consensus.

In cases where information from the studies was unclear or incomplete, we noted the missing data and documented it accordingly. No automation tools were utilized in the data collection process.

Finally, when multiple reports corresponded to a single study, predefined decision rules were applied to select the most relevant data. Any inconsistencies across reports were addressed through a systematic reconciliation process to maintain the integrity of the data included in the review.

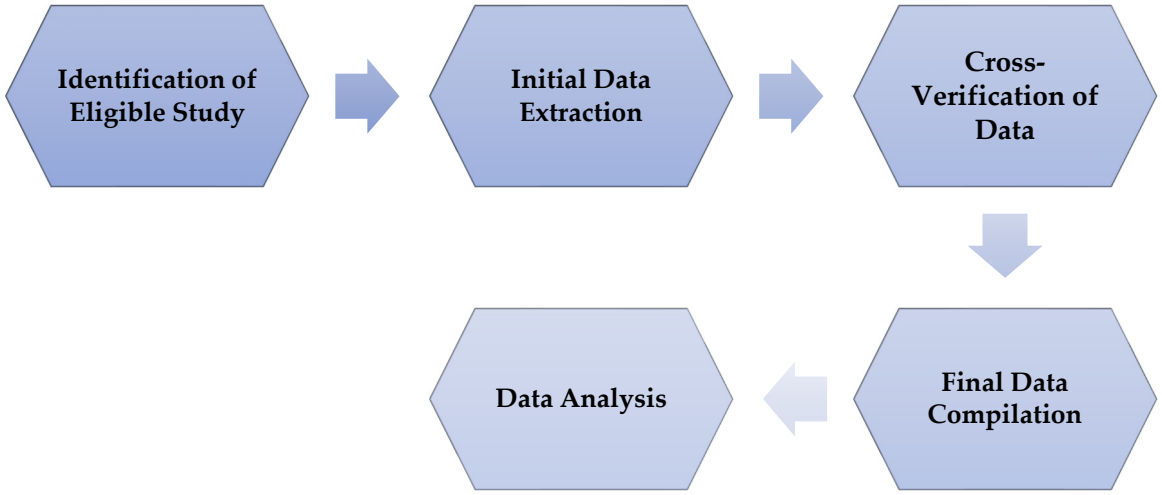

Figure 3. Data Collection Process.

2.6. Data Items

This section describes all the outcomes and variables for which data were sought, including descriptions and criteria for choosing relevant results. It also clarifies the approach taken to handle missing or unclear data and any assumptions made during the data collection process.

2.6.1. Data Collection Method

This section lists and defines the outcomes for which data were searched, including measures such as the operational performance of SMEs, cloud computing adoption, and performance improvements. For every outcome domain, all applicable results consistent with these measures were sought, covering diverse time points, methods, and analyses. When numerous results were convenient within the same domain, a systematic review was used to emphasize the most reliable and appropriate data based on predetermined criteria. This ensured that the analysis presented a methodological and thorough overview of each outcome.

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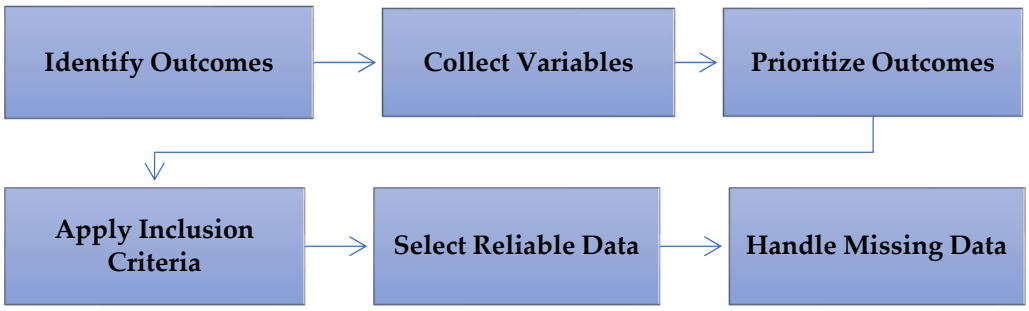

Figure 4. Proposed Data Collection Method.

2.6.2. Variable Data Collection

This section defines and lists all other variables for which data were searched, including participant's characteristics as well as intervention details. Moreover, variables like study design were thoroughly documented. In cases where information was unclear or missing, certain information was gathered to fill gaps, managed by conventional practices from the reference or based on reasonable information from available data. The gathered data was clearly stated to ensure clarity and to reduce the impact of incomplete information or data on the overall analysis.

We gathered data on:

- The journals: title, year, online database, and journal name.
- The study: sample characteristics and geographic location.
- The participants: research design, type of study, sample size, and sample characteristics.
- The research design and features: data collection methods and research design.
- The intervention: technology provider, IT performance metrics, and technology implementation model.

Table 4. Variable Data Collection.

Criteria	Description
Title	Provide a short and descriptive title of the paper or study
Year	Indicate the year the research was published.
Online Database	List where the study was found (e.g., Google Scholar, SCOPUS, Web of Science).
Journal Name	Provide the name of the journal or source of publication.
Research Type	Identify the type of research (e.g., article, conference paper, dissertation).
#Cites	Number of citations the paper has received.
Industry Context	Specify the industry in which the study was conducted (e.g., manufacturing, agriculture).
Geographic Location	Mention the country or region the research is based in.
Economic Context	Note whether the research is from a developed or developing country.
Types of Cloud Computing Services	List the services discussed (e.g., IaaS, PaaS, SaaS).
Cloud Deployment Model	Indicate the deployment model (e.g., public, private, hybrid cloud).
Technology Providers	Mention cloud providers involved (e.g., AWS, Microsoft Azure, Google Cloud).
Technology Implementation Model	Identify the model used (e.g., on-premises, cloud-based, hybrid).
Research Design	Describe the research design (e.g., case study, survey).

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Type of Study	Indicate whether the study is quantitative, qualitative, or mixed methods.
Sample Size	Number of SMEs or participants involved in the study.
Sample Characteristics	Define who the participants are (e.g., IT managers, business owners).
Data Collection Methods	Describe how the data was collected (e.g., interviews, surveys).
Data Analysis Techniques	Identify how the data was analyzed (e.g., statistical analysis, thematic analysis).
IT Performance Metrics	Specify metrics such as system uptime, scalability, or data security.
Business Performance Metrics	Mention operational metrics like efficiency, cost savings, or revenue growth.
Organizational Outcomes	List outcomes such as employee satisfaction or customer satisfaction.
Long-Term Impacts	Identify long-term benefits like business sustainability or competitive advantage.

2.7. Study Risk of Bias Assessment

This section specifies the approaches used to assess the risk of bias in the incorporated studies, comprising details of the tool(s) that were used to effectively manage huge datasets and detect potential biases that might be ignored during manual assessment, several reviewers individually assessed each study, making sure that individual biases were reduced and that an extensive analysis was attained through following discussions and consensus-building. This incorporated approach assured an exhaustive, reliable, and consistent evaluation of the risk of bias across all studies.

In our systematic review of the impact of cloud computing on SMEs' performance, we carried out an exhaustive risk of bias assessment for each incorporated study to ensure the validity and reliability of our findings. We utilized a customized assessment framework derived from the Cochrane 'Risk of Bias ' tool, customized to assess mixed-method studies relevant to our topic. This evaluation covered five (5) distinct domains of bias which are: (1) bias in data privacy; (2) bias due to economic benefits; (3) bias due to data analysis techniques; (4) bias in software architecture applications; and (5) bias in policy and operational problems. Each study was reviewed by three authors independently who documented justifications and supporting information for their risk of bias reviews, classifying them as low, high, or some concerns. Any inconsistencies in their assessments were addressed over cooperative discussions and a 4th author was consulted to settle the arguments if needed. This precise process enabled us to exhaustively review the influence of cloud computing on SME performance, and challenges in the field, identify key advancements, and address any existing gaps and it is demonstrated in Table 5.

Table 5. Study Risk of Bias Process.

Step	Description	Details
Risk of bias tool	Customized Cochrane's Risk of Bia's tool tailored to mixed-method studies	Based on the Cochrane tool adapted to cloud computing research
Bias domains	Five distinct bias domains used for evaluation	(1) Data privacy, (2) Economic benefits, (3) Data analysis techniques, (4) Software architecture, (5) Policy and operational issues
Bias classification	Studies classified into risk levels based on assessment	Low, Moderate, High, or unclear
Consensus process	Discrepancies resolved through discussions	A fourth author was consulted to settle disagreements

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Outcome	Ensured a thorough, reliable evaluation of risk across all studies	Provided clarity on the impact of cloud computing on SMEs' performance

2.8. Synthesis Methods

The synthesis methods for this systematic review on the impact of cloud computing on SMEs' performance were designed to ensure a robust, transparent, and reproducible aggregation of results across the selected studies. The process of determining which studies were eligible for inclusion in each synthesis was conducted with a systematic and rigorous approach, ensuring alignment with the review's objectives, which focus on the role of cloud computing in enhancing SMEs' performance.

Based on Table 6 and Figure 5, the eligibility synthesis involved carefully selecting studies based on their relevance to cloud computing and alignment with the review's objectives. A structured comparison against predefined criteria ensured that only the most pertinent studies were included, minimizing bias and enhancing the review's methodological rigour. Data from various studies were then standardized to facilitate meaningful comparisons, with missing data addressed through techniques like multiple imputation, ensuring a complete and reliable dataset for analysis. Refer to Table 6 the details on data preparation methods and their applications were analysed accordingly. Results were systematically organized into tables and visualized using forest plots, which were crucial in identifying patterns and ensuring that the findings were presented clearly and transparently.

Table 6. Proposed Synthesis Method.

Synthesis step	Description	Methods applied
Eligibility synthesis	Evaluation of studies based on emphasis on cloud computing and alignment with review objectives	Tabulation
Data preparation for synthesis	Preparation of data for synthesis, including conversion to uniform scales and handling of missing data	Standardization, Multiple Imputation
Tabulation and visualization of results	Presentation of results in tables and graphical formats to highlight patterns and ensure transparency	Structured Tables, Forest Plots
Synthesis of results	Data aggregation using meta-analysis models to determine summary estimates and assess consistency across studies	Fixed-Effects Model, Random-Effects Model, Heterogeneity Tests
Exploring causes of heterogeneity	Examination of factors contributing to variability in outcomes through subgroup analysis and meta-regression	Subgroup Analysis, Meta-Regression
Sensitivity analyses	Testing the robustness of the synthesized results by excluding high-risk studies and using alternative models	Sensitivity Tests, Model Comparison

The choice of model was carefully documented to ensure the accuracy and replicability of the findings. Referring to Table 5 a comparison of fixed-effects and random-effects models was conducted to visualize the impact it had on the performance of the SMEs. To explore potential heterogeneity, subgroup analyses, and meta-regression were employed, investigating how various factors, such as SME size or geographic location, might influence the effectiveness of cloud computing. Finally, sensitivity analyses were performed to assess the robustness of the synthesized results. These analyses tested the impact of different assumptions and methodological decisions, ensuring that the review's conclusions were reliable and not unduly influenced by specific factors. Refer to Figure 6 the sensitivity analysis scenarios and outcomes were analysed. This methodical and

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transparent approach to synthesizing evidence on the impact of cloud computing on SMEs ensures that the results are both accurate and replicable.

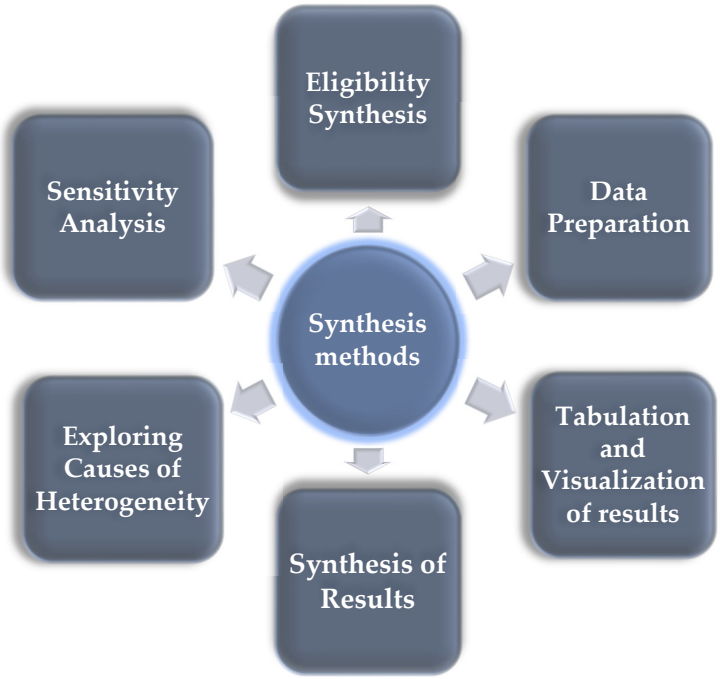

Figure 5. Synthesis Methods.

2.9. Reporting Bias Assessment

In our study, we conducted a systematic assessment of the risk of bias due to missing results, which can stem from reporting biases such as selective non-publication and selective non-reporting of results. The assessment of reporting bias was performed using both statistical and graphical methods to ensure a comprehensive evaluation. We utilized contour-enhanced funnel plots, which were enhanced with contours of statistical significance to visually identify asymmetries that might suggest publication bias. Additionally, Egger's regression test was employed to statistically assess the presence of funnel plot asymmetry.

No specific tools were developed anew for this assessment; instead, we relied on standard tools and techniques recommended in the literature. The contour-enhanced funnel plots were particularly useful in differentiating areas where studies might be missing due to publication bias from those missing due to other factors, such as chance. The entire process of assessment was conducted by multiple independent reviewers to minimize subjective bias. Any disagreements between reviewers were resolved through discussion or by consulting a methodological expert to reach a consensus on the interpretation of results.

Manual analysis and visualization played a significant role in this study. We did not use any automation tools specifically for assessing reporting bias; instead, data were manually analysed and visualized using Microsoft Excel. This approach involved creating charts and plots to identify patterns and potential biases in the reporting, allowing for a detailed examination of the data without reliance on automated software tools.

To ensure accuracy and completeness, we conducted thorough manual searches across multiple online repositories, including Google Scholar, Scopus, and Web of Science. This approach allowed us to cross-reference data across different studies and sources, addressing any discrepancies or concerns about reported outcomes without the need for direct contact with the authors.

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2.11. Certainty Assessment

This section describes the methods employed to assess the certainty or confidence in the evidence gathered for each outcome, ensuring the reliability and strength of the findings. The collected literature was subsequently evaluated on criteria based on a set of five Quality assessment (QA) checks as listed in Table 7.

Table 7. Proposed Research Quality Assessment Questions.

QA	Research Quality Assessment Questions
QA1	Is the aim of the research explicitly stated?
QA2	Does the research clearly specify the data collection methods?
QA3	Is the impact of cloud computing on SMEs' performance clearly analyzed?
QA4	Is there a clear and appropriate research methodology utilized in the study?
QA5	Do the research findings contribute to the existing literature on the impact of cloud computing on SMEs?

The responses to the QAs are rated on a scale between zero (0) and one (1), with a 'No' response assigned '0' points, a score of '0.5' given where the criteria are 'Partially' met, and '1' point assigned to a 'Yes'. All five QAs are scored using this criterion. Each of the literature under review can receive between 0 and 5 points. The results of the QA for the collected literature are tabulated in Table 8.

Table 8. Results of Collected Literature Quality Assessment.

Paper ID.	QA1	QA2	QA3	QA4	QA5	Total	%
[46]	1	0.5	0.5	0.5	0.5	3	60
[47]	1	0.5	1	1	1	4.5	90
[48]	1	1	1	1	1	5	100
[49]	1	0	0.5	0.5	1	3	60
[50]	1	0	0.5	0.5	1	3	60
[51]	1	1	0.5	1	1	4.5	90
[52]	1	0	0.5	0.5	1	3	60
[53]	1	0	0.5	0.5	1	3	60
[54]	1	1	0.5	1	1	4.5	90
[55]	1	1	1	0.5	1	4.5	90
[56]	1	1	0.5	1	1	4.5	90
[57]	1	1	0.5	1	0.5	4	80
[58]	1	0.5	0.5	0.5	1	3.5	70
[59]	1	0.5	0.5	0.5	1	3.5	70
[60]	1	1	1	1	1	5	100
[61]	1	1	1	1	1	5	100
[62]	1	1	1	1	1	5	100
[63]	1	1	1	1	1	5	100
[64]	1	0	0	1	1	3	60
[65]	1	0	1	0	1	3	60
[66]	1	0	0	1	1	3	60
[67]	1	0	0	1	1	3	60
[68]	1	0	1	0	1	3	60
[69]	1	1	0	1	1	4	80
[70]	1	0	1	1	1	4	80
[71]	1	0	1	1	1	4	80
[72]	1	1	1	1	1	5	100
[73]	1	1	1	1	1	5	100
[74]	1	1	1	1	1	5	100

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[75]	1	1	1	1	1	5	100
[76]	1	1	1	1	1	5	100
[77]	1	0	0.5	0.5	1	3	60
[78]	1	1	0.5	1	1	4.5	90
[79]	1	1	1	1	1	5	100
[80]	1	1	1	1	1	5	100
[81]	1	1	1	1	1	5	100
[82]	0.5	0	0.5	0	0.5	1.5	30
[83]	1	0.5	1	1	1	4.5	90
[84]	1	0	0.5	0.5	0.5	2.5	50
[85]	0.5	0	0	0.5	0.5	1.5	30
[86]	1	1	0.5	1	1	4.5	90
[87]	0	0.5	0	0.5	0	1	20
[88]	1	0.5	0.5	0.5	0.5	3	60
[89]	1	0	0.5	0.5	0.5	2.5	50
[90]	1	0.5	0	0.5	0.5	2.5	50
[91]	1	0.5	1	1	0.5	4	80
[92]	1	1	1	1	1	5	100
[93]	1	0.5	0.5	0.5	0.5	3	60
[94]	1	0.5	0.5	0.5	1	3.5	70
[95]	1	0.5	1	1	1	4.5	90
[96]	1	1	1	1	1	5	100
[97]	1	0	0	1	1	3	60
[98]	1	0	0	0	1	2	40
[99]	1	1	0	1	1	4	80
[100]	1	1	1	1	1	5	100
[101]	1	1	0.5	1	1	4.5	90
[102]	1	1	1	0.5	1	4.5	90
[103]	1	1	0.5	1	1	4.5	90
[104]	1	0	0.5	1	0	2.5	50
[105]	1	0	1	0.5	1	3.5	70
[106]	1	0	0.5	0.5	1	3	60
[107]	0.5	0	0.5	0	1	2	40
[108]	1	1	0.5	1	0.5	4	80
[109]	1	1	1	1	1	5	100
[110]	1	0	0	1	1	3	60
[111]	1	0	0	0	1	2	40
[112]	1	1	1	1	1	5	100
[113]	1	1	1	0	1	4	80
[114]	1	0	1	1	1	4	80
[115]	1	1	1	1	1	5	100
[116]	1	1	0	1	0	3	60
[117]	1	0	1	1	1	4	80
[118]	1	1	1	1	1	5	100
[119]	1	0	1	0	1	3	60
[120]	1	0	1	0	1	3	60
[121]	1	0	1	1	1	4	80
[122]	1	1	1	1	1	5	100
[123]	1	0	1	1	1	4	80
[124]	1	0	1	1	0	3	60
[125]	1	1	0	0	1	3	60
[126]	1	0.5	1	1	0.5	4	80

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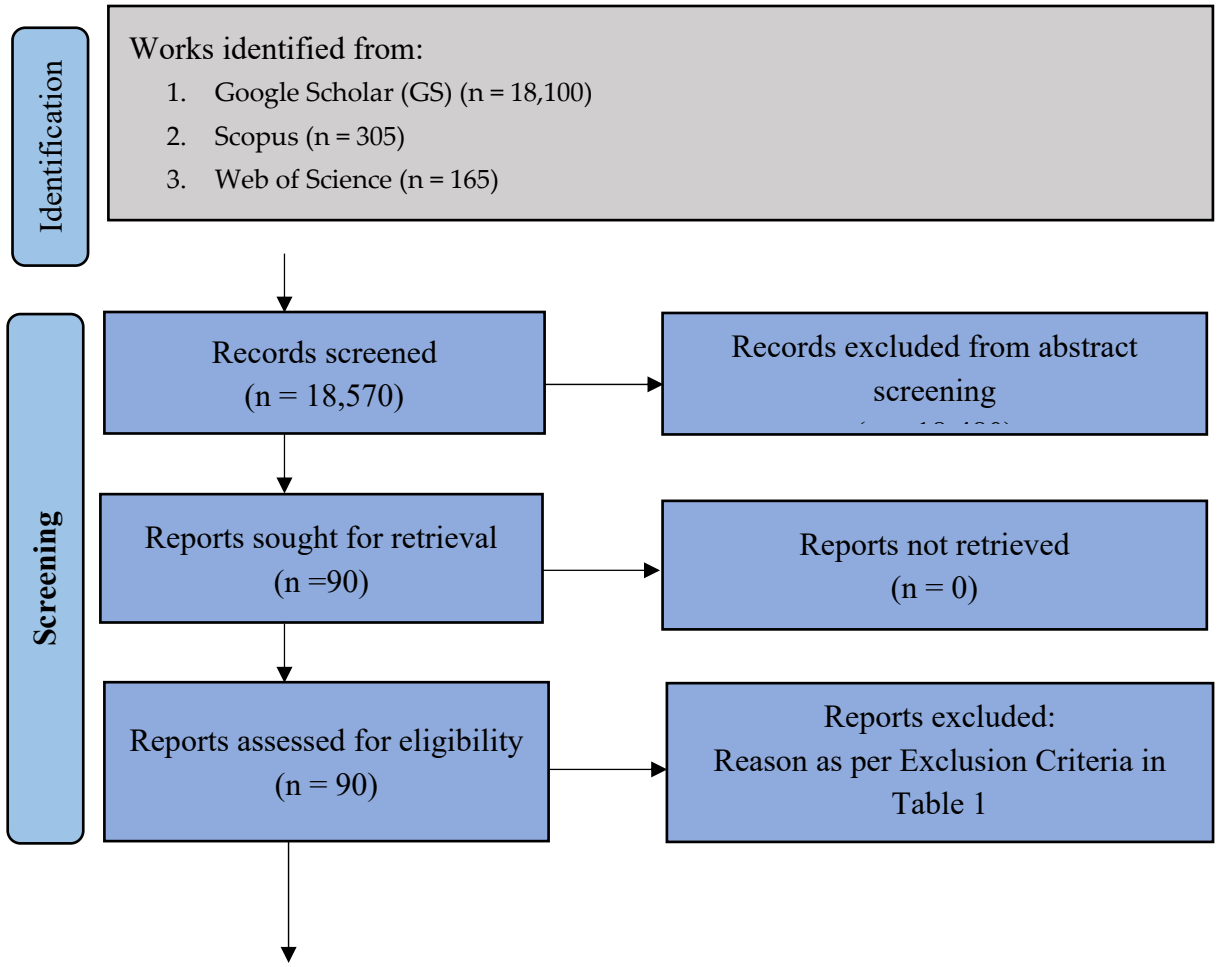
[127]	1	1	0.5	0.5	0.5	4.5	90
[128]	1	1	1	1	0	4	80
[129]	1	0	0.5	1	1	3.5	70
[130]	1	0.5	1	0.5	0.5	3.5	70
[131]	1	1	1	1	1	1	100
[132]	1	0	0	1	1	3	60
[133]	1	1	0	0	0.5	2.5	50
[134,135]	1	0.5	1	1	0	3.5	70
[136]	1	1	1	1	1	5	100

3. Results

This section describes the results including their interpretation, as well as some conclusions that can be drawn from these results.

3.1. Study Selection

The studies selection process of this review was employed as illustrated in Figure 6. The research papers were accumulated from research paper databases with the assistance of the keywords that were mentioned in the "Search strategy" section previously. These research papers were gathered severely in line with the conditions of the inclusion and exclusion criteria presented in the previous "Eligibility criteria" section. The results search yielded approximately 18,570 research papers across all considered research databases, and their titles and abstracts were surveyed. As demonstrated by Figure 9, the collected research papers comprised 90 research papers in total, of which, 40% were from Google Scholar, 28.89% from Scopus, and 31.11% from Web of Science. Out of the 90 research papers, 2 were book chapters, 23 were conference papers, and 65 were journal articles as illustrated in Figure 6. All research papers that seemed to have duplicate research studies were excluded. Therefore, the remaining 90 research papers were qualified for full-text review and were incorporated into this systematic analysis process.



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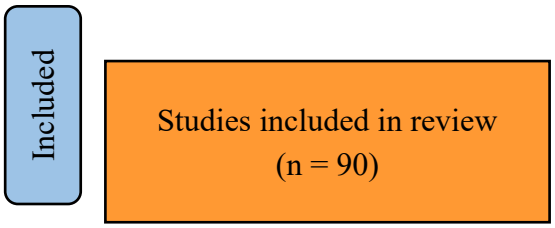

Figure 6. Proposed PRISMA Flowchart.

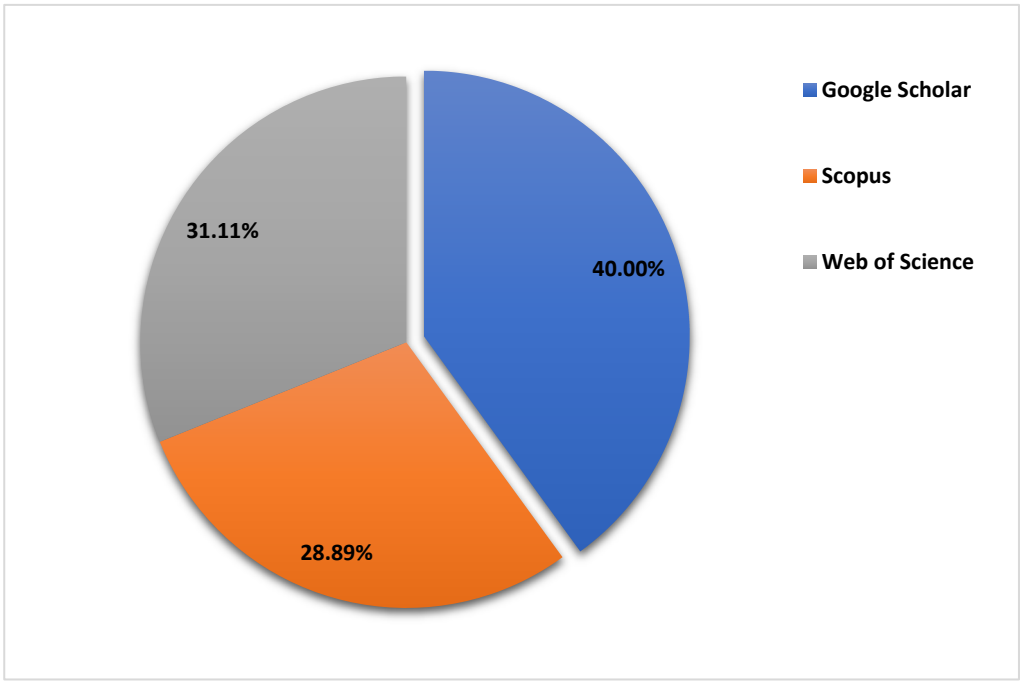

Figure 7. Distribution of Online Database.

3.2. Study Characteristics

Ninety eligible research papers were published between 2014 and 2024. Figure 8 shows the number of research papers published each year, indicating a steady growth in publications since 2014. This highlights the increasing research focus on cloud computing and SMEs over time. The eligible research papers consist of 2 book chapters, 23 conference papers, and 65 journals, as illustrated in Figure 10. This figure categorizes the types of research publications included in the study, showing that journal articles are the predominant source, with 65 papers, followed by 23 conference papers, and 2 book chapters. This breakdown indicates that journals serve as the primary medium for research on cloud computing and SMEs. Table 9 illustrates the number of research papers published by year over the past decade. Since 2014, there has been a steady increase in publications, as depicted in Figure 8. While numerous studies have emerged on cloud computing and SMEs, a comprehensive systematic review analyzing the impact of cloud computing on SME performance has yet to be conducted.

It provides a summary of research works published between 2014 and 2024, including the distribution of book chapters, conference papers, and journal articles by year. The data shows a consistent rise in research output, peaking significantly in 2023 with 12 journal articles, although no book chapters or conference papers were published that year. Throughout the period, journal articles have been the most common type of publication, while conference papers are less frequent, and book chapters are rare, with only two published in 2014 and 2017. Noteworthy years include 2014, with 7 journals, 1 book chapter, and 1 conference paper, and 2019, which saw 8 journal articles and 5 conference papers. This trend highlights the increasing academic focus on cloud computing's influence on SMEs, particularly through peer-reviewed journal articles.

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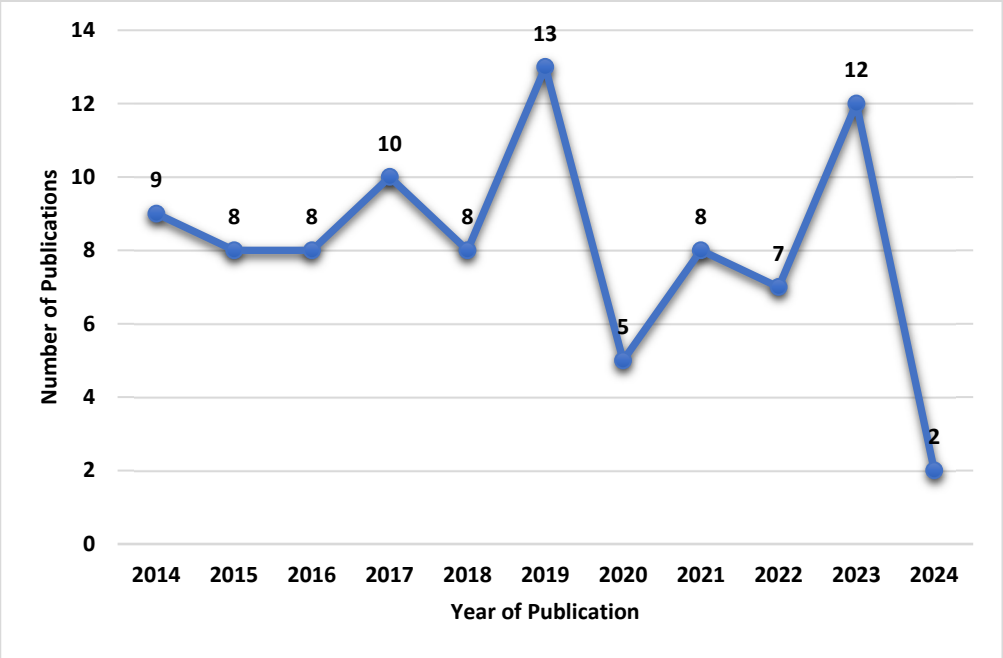

Figure 8. Research papers published by year.

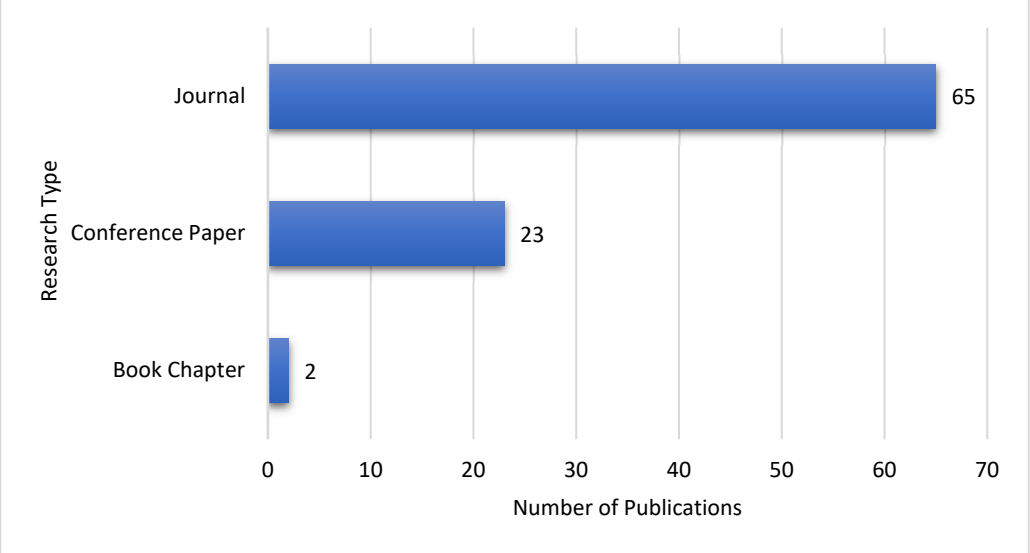

Figure 9. Research Type Indication.

Table 9. Momentary view of research works contained herein by published year.

Published Year	Book Chapter	Conference Paper	Journal
2014	1	1	7
2015	0	3	5
2016	0	5	3
2017	1	1	8
2018	0	1	7
2019	0	5	8
2020	0	1	4
2021	0	3	5
2022	0	3	4
2023	0	0	12

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2024	0	0	2

Figure 10 illustrates the global distribution of research papers on cloud computing and SMEs, revealing a diverse range of contributions across various countries. India leads the field, accounting for 17% of the total publications. This suggests a strong focus on integrating cloud technologies into SMEs within the region, possibly driven by national strategies aimed at boosting digital transformation. China follows with 11%, reflecting its robust industrial base and commitment to maintaining its global competitive edge through technological innovation in the SME sector. Malaysia contributes 9% of the research papers, highlighting its growing interest in cloud computing as a means to support its rapidly expanding SME sector. The notable contributions from Indonesia and the United Kingdom, at 7% and 6% respectively, suggest that these countries are also prioritizing research in this area, likely as part of broader economic strategies to enhance digital capabilities among small businesses. Poland, Rwanda, and Kenya, each at 3%, demonstrate a moderate but significant engagement, indicating a focus on leveraging cloud technologies to support their SME sectors. The remaining countries, including Greece, Turkey, Italy, the Netherlands, Nigeria, South Africa, South Korea, Spain, and the United Kingdom, contribute 2% to 3% each, indicating a widespread yet varied interest in cloud computing research. However, other nations such as Bahrain, Botswana, and Romania show minimal participation, with each contributing 2% or less. This could reflect either the nascent stage of cloud adoption in these regions or a lower prioritization of research in this field. Overall, the chart highlights the regions that are leading in cloud computing research and those that may need to intensify their focus to fully capitalize on the benefits of cloud technologies for SMEs.

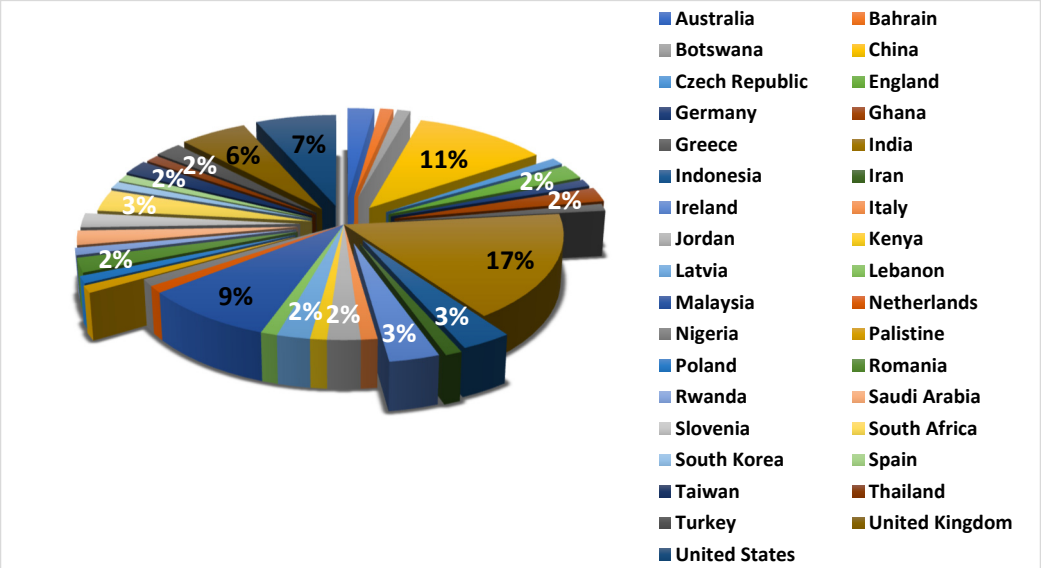

Figure 10. Geographical Distribution of Research Papers.

Table 10 demonstrates the various adoptions of cloud computing across diverse industries and regions, emphasizing its impact on SMEs' business performance. Studies span sectors like transport, manufacturing, finance, and ICT, with sample sizes ranging from 4 to 470. Key findings highlight cloud computing's role in improving organizational performance, though adoption challenges persist, such as cost concerns and readiness assessments. Endorsements are provided for SMEs, service providers, and policymakers to address these challenges and improve cloud computing implementation, particularly in developing economies.

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Table 10. Results obtained from Literature Search.

Study	Industry Context	Sample Size	Contributions
[46]	Transport	86	CC adoption in Latvian SMEs, its impact on business performance, and offers recommendations for SMEs, service providers, and government agencies.
[47]	Manufacturing	415	Cloud-based business services in Malaysian SMEs, analyzing their impact on financial and non-financial benefits, using PLS-SEM to evaluate organizational performance.
[48]	Finance	50	Cloud accounting on intellectual capital and business performance in Sri Lankan SMEs, using a quantitative approach to analyze relationships between these variables.
[49]	ICT	30	Factors influencing cloud computing adoption in SMEs within a developing economy, identifying key drivers, barriers, and influential factors, offering insights for service providers and policymakers.
[50]	ICT	250	Cloud computing adoption among Irish SMEs, revealing low migration rates and insufficient readiness assessments, and practical recommendations for successful cloud adoption.
[51]	ICT	343	Cloud computing adoption in Malaysian SMEs, finding that IT resources and external pressure significantly impact adoption.
[52]	Manufacturing	200	Cloud adoption model for SMEs based on the TOE framework and individual characteristics, identifying key factors like relative advantage, vendor support, and CEO trust.
[53]	ICT	7	The paper discusses the potential of cloud computing to enhance European SMEs' business efficiency, particularly through e-learning.
[54]	Finance	12	Cloud computing adoption by SMEs in sub-Saharan Africa, particularly in Nigeria.
[55]	ICT	112	Impact of cloud computing on business performance in Turkish SMEs, finding a positive effect on performance despite general reluctance.
[56]	Accounting	198	Cloud computing adoption in Romanian SMEs, identifying key influencing factors such as managerial knowledge and perceived costs.
[57]	Manufacturing	90	IT resources significantly impact cloud computing adoption in Malaysian SMEs, while top management support and employee knowledge do not.
[58]	ICT	470	SMEs' role in national economies and how cloud computing boosts their productivity and global competitiveness.

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[59]	Finance	14	SMEs' perceptions of cloud computing solutions and their benefits, focusing on Romania's North-West region. It assesses awareness levels and provides insights for both IT solution providers and SMEs.
[60]	Manufacturing	120	The study examines how the cloud of things impacts performance in Indian SMEs, analyzing factors such as security, ease of use, and top management support.
[61]	Manufacturing	7	Cloud computing boosts Nigerian SMEs' efficiency but faces adoption challenges. The study aims to develop a framework for evaluating and improving cloud services for SMEs.
[62]	-	-	Cloud computing addresses key challenges for South African SMEs, including red tape and IT costs. A Cloud Adoption Framework, based on the TOE model, is proposed to enhance SME survival rates.
[63]	Marketing	372	Examines determinants of cloud computing adoption in SMEs and measures its impact on firm performance by enhancing organizational agility.
[64]	Manufacturing	317	Determinants of cloud adoption in Indian SMEs validated, showing the impact on economic performance.
[65]	ICT	305	SMEs include relative advantage, compatibility, complexity, cost savings, and security, with adoption depending on relative advantage, compatibility, cost, and security.
[66]	Manufacturing	170	SMEs in Sabah, Malaysia, while a relative advantage, competitive pressure, and external support do not significantly impact adoption.
[67]	ICT	95	Cost benefits drive cloud adoption in Irish SMEs, but service availability concerns limit uptake.
[68]	ICT	80	Cloud computing offers affordable solutions for SMEs, particularly in developing countries like Saudi Arabia, based on a comprehensive survey of small businesses on the West Coast.
[69]	-	11	Cloud computing adoption strategies for Sub-Saharan African SMEs identified key factors: setting goals, creating a roadmap, and tailoring strategies to enhance growth and customer experience.
[70]	Manufacturing	300	Cloud-based ERP adoption in Penang SMEs: Top management support positively impacts the manufacturing sector; other factors show no significant effect.
[71]	Manufacturing	9	Positive impact on SMEs' non-financial performance; negative impact on financial performance.

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[72]	ICT	36	Cost benefits and scalability drive adoption; barriers include broadband issues and vendor lock-in. TOE framework identifies key enablers and organizational factors.
[73]	-	-	Key factors include cost reduction, security, and management support; Diffusion of Innovation (DOI) and Technology Organization and Environment (TOE) theories frame the study.
[74]	ICT	-	Indian SMEs face challenges and costs; this paper reviews ERP deployment models, and cost factors, and presents a framework for evaluating cloud-based ERP feasibility.
[75]	ICT	-	SMEs can overcome high costs and resource limitations; and explore HPC requirements, cluster-based applications, Google's HPC Cloud, and vendor performance.
[76]	Manufacturing	100	Key factors influencing adoption to aid in expanding cloud use among SMEs.
[77]	ICT	-	Cloud computing methodologies examine various systems and discuss applications to highlight their transformative impact on technology and business operations.
[78]	Manufacturing	-	The study identifies key factors for cloud computing adoption in Indian MSMEs, highlighting 'previous technological experience' as crucial.
[79]	Manufacturing	-	Cloud computing and smart device model to enhance inventory management in fashion SMEs.
[80]	Manufacturing	30	Examines cloud computing adoption predictors in SMEs using SEM and ANN, highlighting server location and management support as key factors.
[81]	ICT	387	The study investigates cloud computing adoption's impact on SME sustainability.
[82]	Business & Economics	209	Influence of cloud computing adoption in Malaysian SMEs. It finds data security, technology readiness, and top management support as key predictors, with adoption intention mediating the relationship between these factors and actual usage.
[83]	ICT	335	The study identifies relative advantage, competitive pressure, compatibility, and industry pressure as key factors in cloud computing adoption among Czech SMEs.
[84]	ICT	273	The study examines how cloud computing assimilation reduces supply chain financing risks for SMEs.
[85]	Business & Economics	14	Factors affecting cloud technology implementation for Industry 4.0 in MSMEs.

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			System integration, project management, and competitive pressure.
[86]	ICT	20	The study tests existing cloud computing adoption models for suitability in Irish SMEs and finds they are inadequate.
[87]	ICT	230	Cloud computing adoption in Lebanese SMEs using the TOE framework: technological and organizational factors positively impact adoption, while poor infrastructure and lack of government support hinder it.
[88]	ICT	415	Integration enhances environmental, financial, and social performance, offering practical insights for policymakers and managers.
[89]	ICT	415	The study finds that perceived benefit and upper management support drive cloud computing adoption in Palestinian SMEs, which in turn enhances performance.
[90]	-	147	Cloud computing impacts SMEs and large firms in India, finding SMEs benefit more due to better business scalability.
[91]	Accounting	-	Cloud computing into SME accounting systems improves management efficiency and economic settlements in China: risk management and secure network protections.
[92]	Finance	-	SME accounting system using cloud computing and sensor monitoring, resulting in a 13.84% increase in data accuracy and a 14.63% boost in processing efficiency compared to traditional systems.
[93]	-	-	Cloud strategies for SMEs focus on scalability, cost-effectiveness, performance, and efficiency.
[94]	ICT	-	The paper highlights the benefits of cloud over traditional methods for small and large enterprises.
[95]	ICT	-	Cloud adoption drivers for SMEs in Indonesia, using e-survey data analyzed with SPSS and Smart PLS.
[96]	-	-	The study proposes cryptographic mechanisms to ensure data uniqueness and security in cloud storage.
[97]	ICT	-	This study proposes a framework to explore how digital organizational culture impacts cloud computing adoption in SMEs.
[98]	-	-	It highlights security and privacy concerns as key inhibitors and aims to develop strategies to enhance cloud adoption.
[99]	ICT	202	SMEs in Kenya, despite their growth and potential benefits, are slow to adopt cloud computing.
[100]	ICT	-	This study evaluates cloud computing adoption among SMEs in Saudi Arabia.

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[101]	Accounting	-	Cloud accounting adoption in SMEs, influenced by TOE factors, enhances organizational performance.
[102]	Agriculture	-	Exploring the impact of cloud computing on SMEs in Africa reveals enhanced operational efficiency, scalability, and cost savings.
[103]	ICT	25	Cloud computing adoption in Malaysian enterprises remains low. Key factors influencing adoption include security, top management support, cost savings, and competitive, and trading partner pressures.
[104]	Business & Economics	197	The model highlights critical factors and their impact on performance.
[105]	ICT	-	Cloud computing adoption in Somali SMEs is driven by cost savings, firm size, top management support, and regulatory support, while security concerns and competitive pressure are less significant.
[106]	Retail	227	This study examines how Cloud Computing Utilization (CCU) helps Emerging Market SMEs in Iran and Turkey overcome informational and marketing barriers.
[107]	Business & Economics	203	fsQCA reveals complex causations and configurations not captured by traditional methods, offering new theoretical and practical insights.
[108]	ICT	-	Cloud adoption in Botswana: recommendations for a tailored adoption framework are also provided.
[109]	ICT	249	This study investigates how technological, organizational, and environmental factors influence IT managers' decisions to adopt cloud computing in the UK.
[110]	Manufacturing	200	This study explores how technological, organizational, and environmental (TOE) factors influence cloud accounting adoption in SMEs, emphasizing the mediating role of a cloud computing vision.
[111]	ICT	249	Examines cloud computing adoption intentions, pricing strategies, and deployment models, highlighting factors that influence decision-making and implementation in organizations.
[112]	ICT	36	Promotes cloud computing adoption and use among agile software developers in South Africa, focusing on enhancing development efficiency and flexibility.
[113]	Engineering	-	Explores IT adoption in Indian SMEs, highlighting opportunities and challenges for enhancing business operations and growth.

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[114]	Business & Economics	-	Examines how cloud computing technology enhances small business performance by leveraging internet-based solutions.
[115]	Finance	-	Explores the development and implementation of an intelligent ERP platform for SMEs utilizing cloud computing technology.
[116]	ICT	-	Proposes a model to enhance cloud-based service adoption in Indian SMEs, addressing key factors for successful implementation.
[117]	ICT	-	Analyzes opportunities for SMEs in leveraging cloud high-performance computing, highlighting potential benefits and strategies through a meta-analysis.
[118]	Engineering	-	Proposes a hybrid method to enhance the quality of service for SMEs facing availability constraints in cloud environments.
[119]	ICT	216	Explores how cloud computing impacts small businesses by enhancing flexibility, reducing costs, and improving efficiency.
[120]	ICT	-	Proposes a conceptual model to enhance performance and sustainability in SMEs using cloud computing technology.
[121]	Business & Economics	-	Develops a questionnaire to assess SMEs' ongoing use behaviour of cloud computing services, focusing on continuous engagement and satisfaction.
[122]	ICT	-	Examines how SMEs apply and adopt big data technologies, focusing on the benefits and challenges of integration into their operations.
[123]	Accounting	-	Analyzes the key factors influencing the adoption of SaaS ERP systems in SMEs and the challenges they face during implementation.
[124]	ICT	-	Evaluates the performance of enterprise cloud computing systems, focusing on efficiency, reliability, and cost-effectiveness.
[125]	ICT	-	Describes the Cloud SME platform as a versatile multi-cloud solution for creating and running commercial cloud-based simulations.
[126]	Engineering	-	Explores interoperability challenges in cloud manufacturing through a case study on a private cloud structure tailored for SMEs.
[127]	Business & Economics	4	Examines the adoption of cloud computing by an SME in a developing economy, highlighting challenges and strategies for reaching cloud-based solutions.
[128]	ICT	-	Explores how Platform-as-a-Service (PaaS) solutions enable cloud-based Computational Fluid Dynamics (CFD), enhancing flexibility and scalability for users.
[129]	Engineering	-	Examines how compliance, network, and security factors moderate the success of implementing Cloud ERP systems,

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			highlighting their impact on critical success factors.
[130]	ICT	208	Explores how cloud-based cross-system integration enhances connectivity and efficiency for small and medium-sized enterprises (SMEs).
[131]	Business & Economics	-	Analyzes the key factors influencing Software-as-a-Service (SaaS) adoption in small businesses, focusing on risks, benefits, and both organizational and environmental determinants.
[132]	ICT	198	Proposes a personalized approach to customizing cloud manufacturing services to better meet individual business needs and enhance service efficiency.
[133]	Engineering	-	Examines different collaboration types and success factors in the IT service industry that contribute to sustainable growth.
[134]	ICT	127	Introduces the PaaS port semantic model, an ontology designed to enhance semantic interoperability in platform-as-a-service (PaaS) marketplaces.
[135]	ICT	-	Explores strategies for selecting cloud resource configurations across multiple layers in the context of big data, focusing on optimizing performance and resource utilization.
[136]	Manufacturing	20	Offering flexible and scalable solutions, cloud technology enhances process efficiency, collaboration, and agility.

3.3. Risk of Bias in Studies

Table 11 assesses the risk of bias in various studies based on key methodological criteria. Random Sequence Generation determines whether participants were randomly assigned to groups, influencing selection bias, while Allocation Concealment checks if the group assignment process was hidden from those conducting the study. Blinding of Participants and Personnel ensures that neither participants nor researchers knew which interventions were administered, reducing Performance Bias, whereas Blinding of Outcome Assessment focuses on whether outcome evaluators were similarly unaware of preventing Detection Bias. Incomplete Outcome Data addresses how missing data were managed to avoid Attrition Bias, and Selective Reporting evaluates whether all pre-specified outcomes were reported, identifying potential Reporting Bias if selective omissions were made. Other Bias encompasses any additional factors, such as conflicts of interest or study design flaws, that could influence the outcomes. The Overall Risk of Bias summarizes the study's credibility, with ratings ranging from Low (indicating minimal bias) to High (indicating significant concerns). These categories provide a comprehensive assessment of each study's reliability and potential sources of bias.

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Table 11. Results of Risk of Bias in Research Studies.

Ref.	Random Sequence Generation (Selection Bias)	Allocation Concealment (Selection Bias)	Blinding of Participants and Personnel (Performance Bias)	Blinding of Outcome Assessment (Detection Bias)	Incomplete Outcome Data (Attrition Bias)	Selective Reporting (Reporting Bias)	Other Bias	Overall Risk of Bias
[46]	Low	Low	High	Low	Low	Unclear	Low	Moderate
[47]	High	Unclear	Low	High	Low	High	Low	High
[48]	Low	Low	Low	Unclear	Low	Low	Low	Low
[49]	Unclear	High	High	High	High	Unclear	High	High
[50]	Low	Low	Unclear	Low	Low	Low	Low	Low
[51]	Low	Low	Low	Low	Low	Low	Low	Low
[52]	Low	Low	Unclear	Low	Low	Unclear	Low	Moderate
[53]	High	Low	Low	High	High	Unclear	High	High
[54]	Unclear	High	High	Low	Low	Low	Low	High
[55]	High	Low	Low	High	High	Low	High	High
[56]	High	Low	Unclear	High	High	Low	High	Moderate
[57]	Low	Low	Low	High	High	Low	High	Moderate
[58]	Low	Low	Unclear	High	Low	Low	High	Low
[59]	High	Low	Unclear	High	High	Low	High	High
[60]	Low	Low	Low	Low	High	Low	High	Moderate
[61]	High	High	High	High	Low	Low	High	High
[62]	High	Low	Unclear	Low	High	Low	High	Moderate
[63]	Low	Low	Low	High	High	Low	High	Low
[64]	Low	Low	Unclear	High	High	Low	High	Low
[65]	High	Low	High	High	High	Low	High	High
***	***	***	***	***	***	***	***	***
***	***	***	***	***	***	***	***	***
***	***	***	***	***	***	***	***	***
[126]	Low	Low	Unclear	High	High	Low	High	Moderate
[127]	Low	Low	Low	High	low	Low	High	Low
[128]	Low	Unclear	High	Unclear	High	Low	High	Low
[129]	Low	Low	Unclear	High	High	Low	High	Moderate
[130]	Low	High	High	High	High	Low	High	High
[131]	Low	Unclear	Low	High	High	Low	High	Moderate
[132]	Low	Unclear	Unclear	High	High	Low	High	Moderate
[133]	Low	Low	Low	High	High	Low	High	Low
[134]	High	High	Unclear	High	High	Low	High	High
[135]	High	Low	High	High	High	Low	High	High
[136]	Low	Low	High	Low	Low	Unclear	Low	Moderate

Figure 11 illustrates the distribution of research design types employed in studies examining the impact of cloud computing on SMEs. Of the 90 papers reviewed, surveys are the predominant research design, accounting for 65 instances. This preference highlights the focus on collecting extensive, generalizable data that can be statistically analysed, which is consistent with the quantitative research trend. Surveys are particularly effective for reaching a wide range of SMEs and obtaining standardized responses regarding cloud adoption, benefits, and challenges.

In contrast, case studies and experimental designs are less common, with 13 and 12 instances, respectively. Case studies provide in-depth, contextual insights into specific cases of cloud computing adoption, offering a qualitative exploration of the unique experiences of individual SMEs. Experimental designs, though less frequent, are valuable for establishing cause-and-effect

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relationships by controlling variables, thus providing more robust evidence of cloud computing's impact.

The "not specified" category, comprising 12 instances, likely includes studies with mixed research designs or those with undefined approaches, possibly due to a focus on theoretical or exploratory research. Most survey-based studies underscore the emphasis on gathering quantifiable, broadly applicable data, while the inclusion of case studies and experimental designs contributes additional depth and rigour to the research.

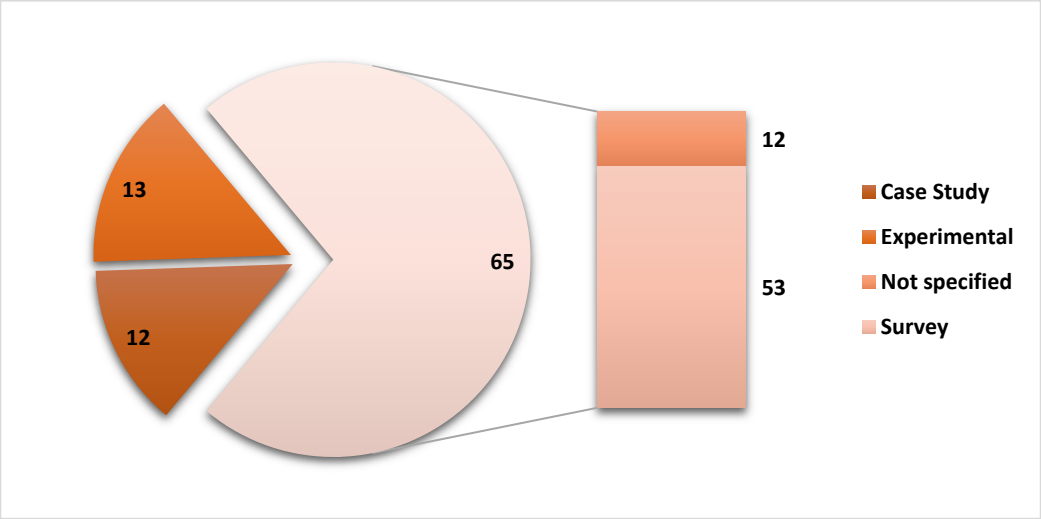

Figure 11. Research design.

Using data from 90 publications gathered from Google Scholar, Scopus, and Web of Science, the graph in Figure 12 illustrates the data-gathering techniques used in research on the effects of cloud computing on SMEs. Surveys and questionnaires are the most utilized methods, with 21 and 37 instances, respectively. The need to collect extensive, quantitative data from a wide sample of SMEs is shown by this trend. Questionnaires and surveys are particularly effective in quantitative research, allowing researchers to collect standardized data on performance metrics like cost savings, operational efficiency, and the challenges associated with cloud adoption. Though less prevalent, case studies with 10 instances and interviews with 6 instances are essential for offering detailed, contextual insights into cases of SMEs adopting cloud computing.

These techniques are more in line with qualitative research, which aims to investigate the distinct viewpoints and experiences of SMEs. The low frequency of empirical studies (1) suggests that this approach is not as popular in this setting, maybe because conducting controlled trials in actual corporate settings can be difficult. Studies that integrate multiple methodologies or use theoretical approaches without well-defined data collection strategies are probably included in the "not specified" category (15). In general, the prevalence of surveys and questionnaires indicates the field's emphasis on quantifiable results, although case studies and interviews provide crucial qualitative depth

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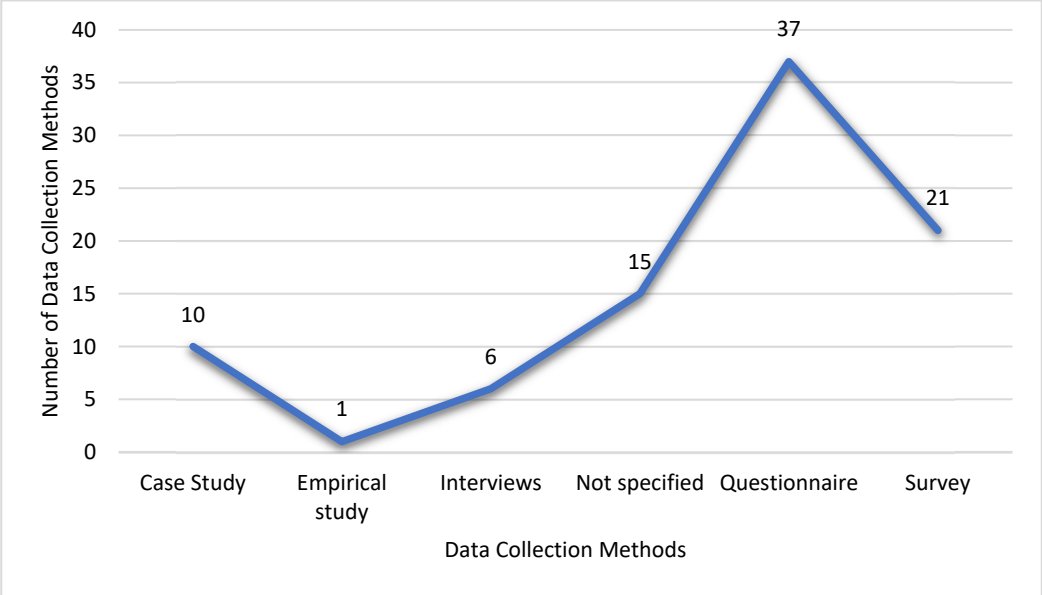

Figure 12. Data Collection Methods.

3.4. Results of Individual Studies

Figure 13 reveals a significant disparity in the reporting of sample sizes among the studies reviewed on the impact of cloud computing on SMEs. Notably, 38 studies did not specify their sample sizes, which is concerning as it limits the ability to assess the generalizability and reliability of their findings. This lack of transparency can introduce a risk of reporting bias, making it difficult to determine the robustness of the evidence presented in these studies.

Among the studies that did specify their sample sizes, there is a clear preference for smaller sample sizes, with 15 studies involving 0-50 participants. While small samples may be more feasible in terms of research logistics, they can also limit the statistical power and external validity of the study results. Conversely, only a small number of studies employed large sample sizes, with just 3 studies exceeding 400 participants. These larger studies are more likely to provide reliable and generalizable findings, but their rarity suggests that such rigorous approaches are not the norm in this research area.

The chart also shows a moderate number of studies with mid-range sample sizes, particularly in the 201-250 participant range (11 studies). These studies likely strike a balance between feasibility and the need for sufficient statistical power. Therefore, the graph indicates a diverse approach to sample size selection, with a substantial proportion of studies at risk of bias due to small or unspecified sample sizes. This variation in sample sizes across the reviewed studies underscores the need for cautious interpretation of the findings in the systematic review.

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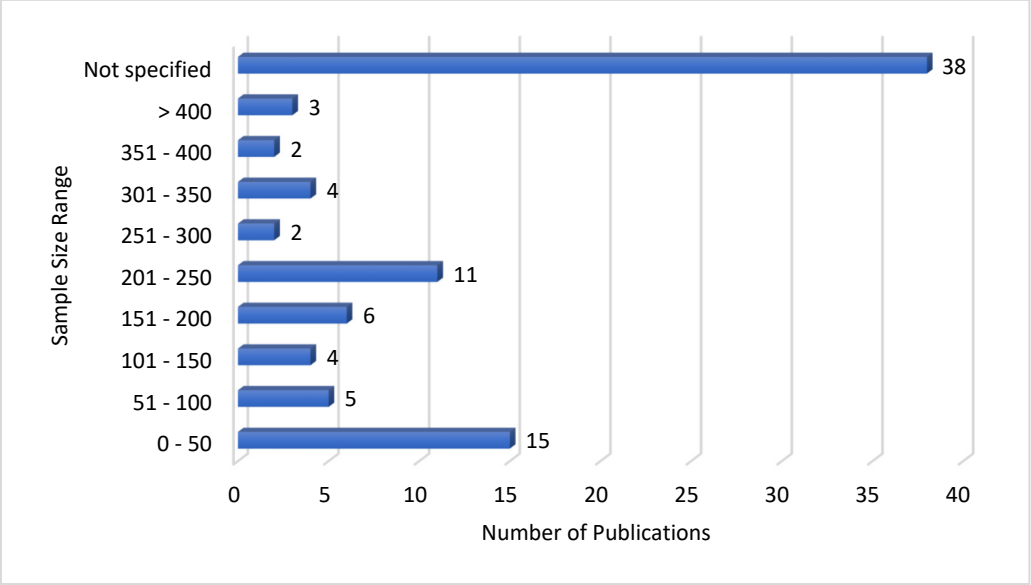

Figure 13. Sample Size Range.

3.5. Results of Syntheses

Figure 14 shows the data analysis technique affecting the distribution of published studies. The most explored configurations include Statistical analysis that dominates the chart with 47 instances and the papers that did not specify which method they used have about 24 instances. These combinations are favoured due to their balance of reliability and as evidenced by statistical analysis showing a significant positive correlation between these factors and overall performance metrics. The inclusion of Thematic Analysis, which consists of 3 instances that emerge as key factors highlights their importance in the overall evaluation of performance. The combination of both Statistical and Thematic Analysis contributes about 3 instances then fewer common configurations, such as PLS-SEM, ISM, MICMAC, IBM SPSS, and Smart PLS consists of an instance of 1 that indicates a growing interest in utilizing or evaluating cloud computing on SME performance.

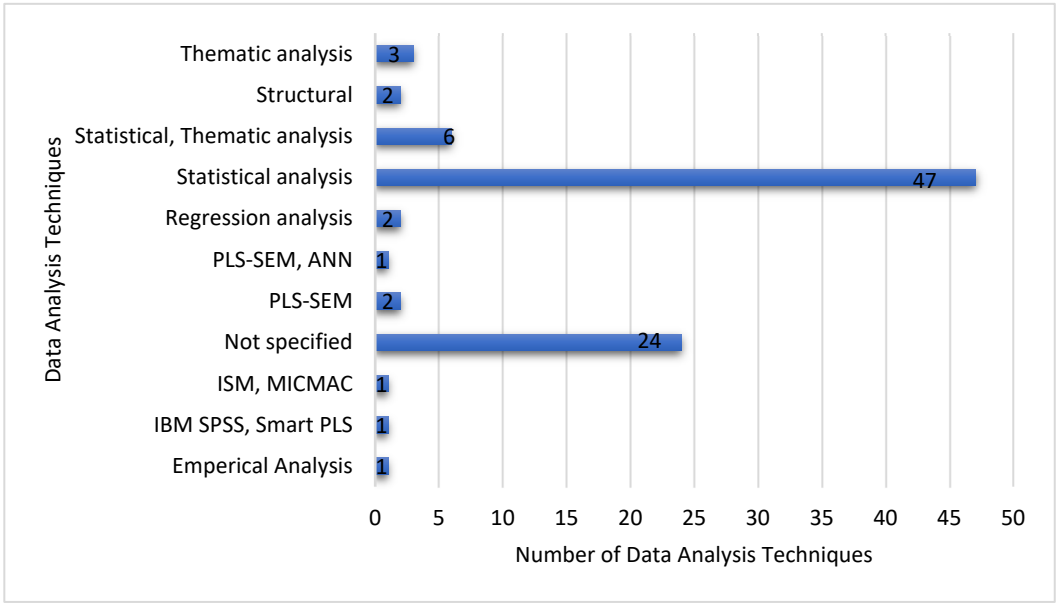

Figure 14. Data Analysis Techniques.

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3.6. Reporting Biases

Figure 15 illustrates that quantitative studies predominate research on cloud computing's impact on SMEs, accounting for 44 out of 90 papers collected. This supremacy reflects the necessity for generalizable and measurable data to assess key performance metrics like operational efficiency, cost savings, and revenue growth—factors critical to cloud adoption evaluation. When evaluating the advantages and difficulties of integrating cloud technologies, decision-makers in SMEs can rely on the objective, trustworthy findings produced by quantitative approaches, which are based on statistical analysis of numerical data.

After quantitative research, 25 papers using mixed methodologies and 15 publications using qualitative investigations. By combining the advantages of qualitative and quantitative methods, mixed-methods research validates statistical data with contextual insights to provide a more thorough knowledge of how cloud computing affects SMEs. Qualitative research offers rich, complicated insights into SMEs' experiences with cloud computing, reflecting the challenges of adoption and execution even though it is less generalizable. The few studies that do not state their methodology are probably exploratory or theoretical in nature. Overall, mixed-methods and qualitative studies contribute, but quantitative research takes the lead because of its transparent, data-driven approach.

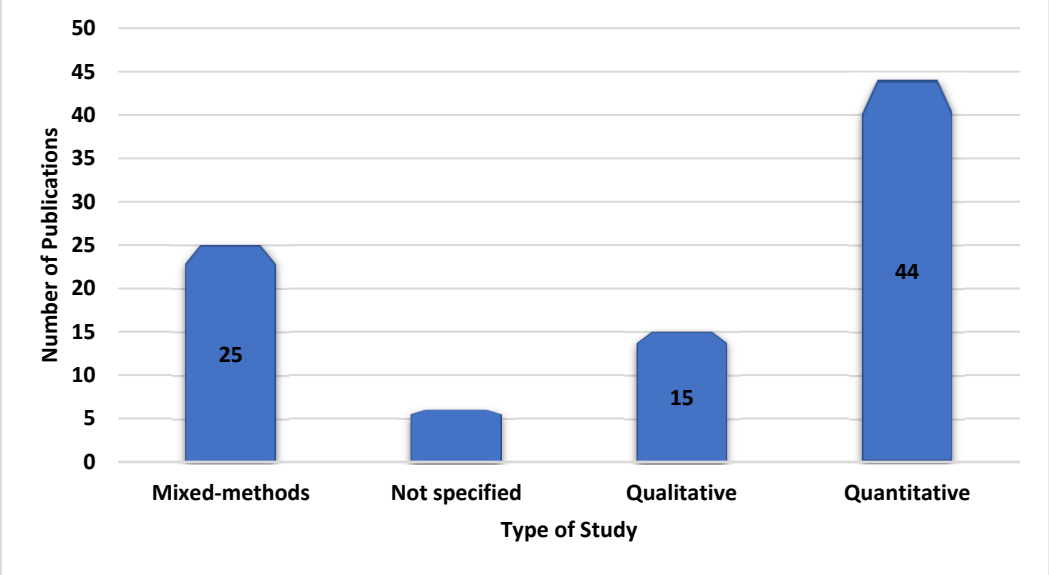

Figure 15. Type of Research Studies.

3.7. Certainty of Evidence

The predominant preference for cloud-based solutions among SMEs, as reflected in Figure 16 consisting of 70 instances, stems from their cost efficiency, scalability, and access to advanced technologies. Cloud-based services offer SMEs a pay-as-you-go model that reduces the need for significant upfront capital investment and allows for flexible resource scaling based on demand. This flexibility is crucial for SMEs with fluctuating needs or growth ambitions. Additionally, cloud solutions alleviate the burden of maintenance and updates, enabling SMEs to focus on their core business activities while benefiting from cutting-edge technologies that might otherwise be too costly or complex to implement independently.

In contrast, the limited representation of hybrid that has an instance of 1 and on-premises consisting of 3 instances in the graph models highlights their relative rarity among recent evaluations. Hybrid models, which combine on-premises and cloud resources, due to their complexity and potentially higher costs, which may not align with the resource constraints of SMEs are less common. On-premises solutions are even less favoured mostly because they require more frequent maintenance and a larger initial expenditure, which can be prohibitive for SMEs looking for more

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flexible and affordable choices. This pattern emphasizes how cloud-based technologies are becoming more and more popular as a beneficial option for improving SME performance.

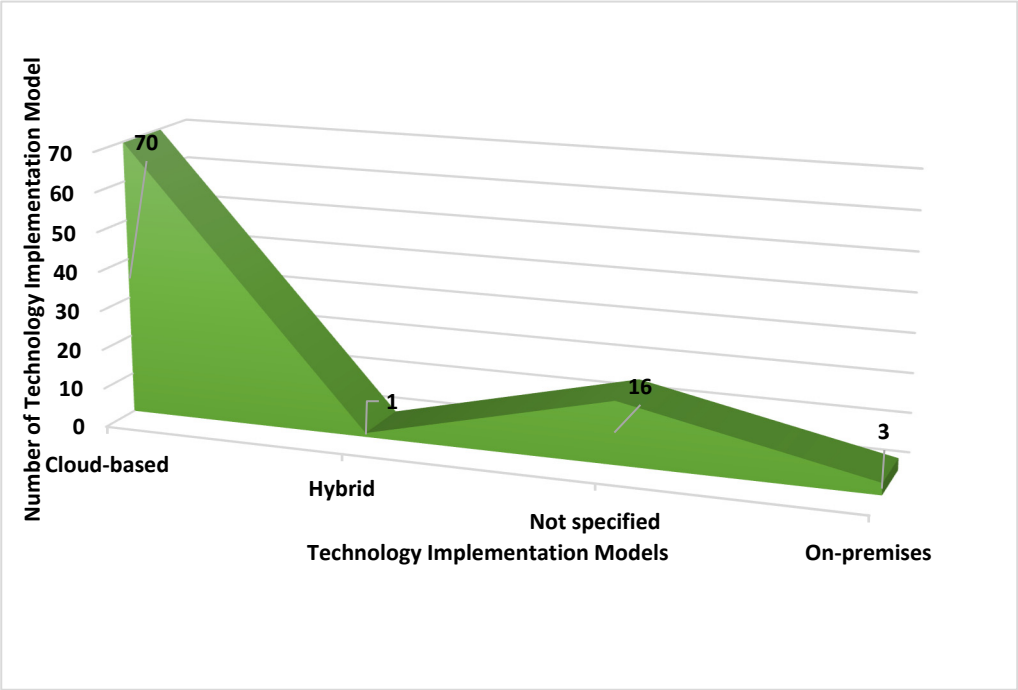

Figure 16. Implementation of Technology Models.

The distribution of participants in the study on cloud computing's impact on SMEs reveals a strategic focus on gathering insights from various key stakeholders within these enterprises. This is illustrated in Figure 17, with 64 participants from SMEs themselves, the research captures a broad spectrum of firsthand experiences regarding the adoption, challenges, and benefits of cloud technologies. IT Managers, who account for 10 participants, play a pivotal role in implementing and managing these technologies, making their insights essential for understanding the technical complexities and operational impacts. Employees, although fewer in number with 6 participants, provide valuable input on how cloud computing affects daily workflows and productivity within SMEs.

Business owners and higher-level executives like CTOs and CEOs, though represented by smaller numbers, offer critical perspectives on the strategic decision-making processes behind cloud adoption. Their involvement sheds light on the motivations for investing in cloud technologies, such as cost savings, competitive advantage, and long-term business sustainability. The inclusion of participants with unspecified roles, along with the varied representation across different organizational levels, ensures that the research offers a comprehensive view of cloud computing's multifaceted impact on SMEs. This holistic approach is crucial in assessing how cloud technologies influence not only the technical and operational aspects but also the strategic direction and overall growth of SMEs.

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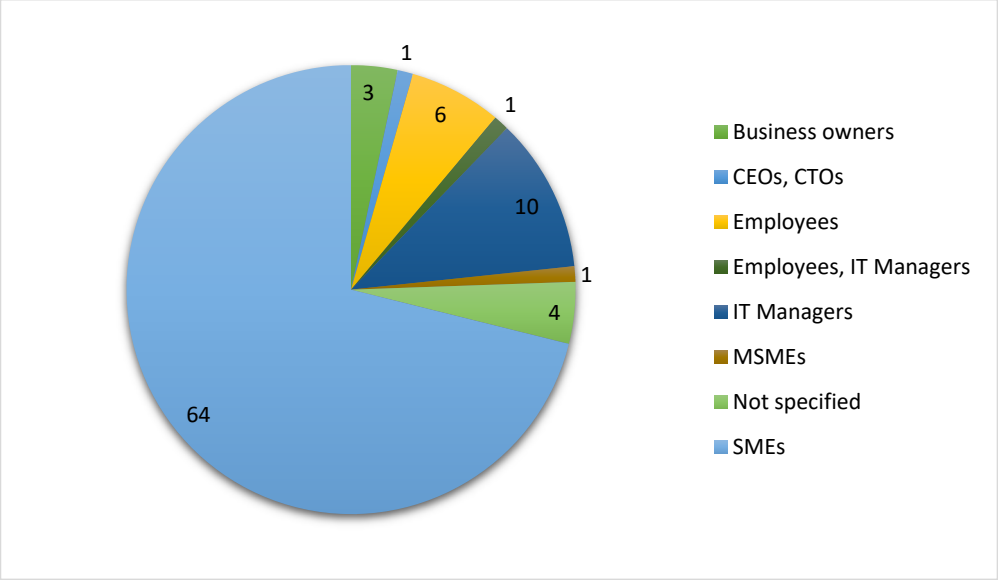

Figure 17. Studies Participants.

4. Discussion

The literature collected after the PRISMA flowchart is used to formulate the responses to the five research questions developed in Section 1.1 concerning the impact of cloud computing on SME performance.

RQ1: Why should SMEs make use of cloud computing to perform their business functions?

Cloud computing provides significant advantages for SMEs by addressing their common limitations in financial and technical resources. Through a pay-as-you-go model, cloud services allow SMEs to access essential IT resources without the need for substantial upfront investments. Cloud solutions such as Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS) enable businesses to scale their infrastructure based on demand, making it easier to adapt to operational changes without the overhead of traditional IT systems. This model also promotes cost-efficiency, as SMEs only pay for what they use, reducing the need for extensive infrastructure maintenance. In addition to flexibility, cloud services grant SMEs access to advanced, enterprise-grade technology, helping them compete more effectively with larger companies.

RQ2: What potential and future expectations do cloud computing services present on SMEs?

The future of cloud computing in SMEs lies in its potential to drive innovation and support digital transformation. Cloud services enable SMEs to become more agile and efficient, making it easier for them to compete with larger businesses. By adopting cloud technology, SMEs can improve their response times, customer service, and overall agility, allowing them to operate more effectively in competitive markets. In the long term, cloud adoption supports business growth through automation, data-driven decision-making, and streamlined business processes. As more businesses transition to digital-first models, cloud technology will play an increasingly central role in ensuring SMEs remain competitive and can adapt smoothly to digital advancements.

RQ3: What is the impact of utilizing cloud computing services on the business performance of SMEs?

Cloud computing has a profound impact on the overall performance of SMEs, particularly when it comes to operational efficiency and cost savings. By adopting cloud services, SMEs can automate many of their processes and use flexible IT resources to scale operations more effectively. This leads to better resource management, quicker processing times, and improved efficiency across their business operations. Additionally, cloud adoption eliminates the need for costly physical hardware and reduces energy and maintenance expenses. Beyond operational improvements, cloud computing

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fosters innovation, enabling SMEs to quickly deploy new services, collaborate more easily, and explore new business models to drive growth and competitiveness.

RQ4: What are the costs involved in using cloud computing technology, and how does it affect a company's budget?

Cost considerations are a critical aspect of SMEs' adoption of cloud computing. While cloud services offer significant upfront savings by eliminating the need for in-house IT infrastructure, businesses face ongoing operational expenditures (OPEX) related to subscription costs. This shift from capital expenditures (CAPEX) to OPEX can make budgeting more predictable but also introduce continuous service costs. SMEs must also account for hidden expenses such as data migration, employee training, and the possibility of cloud downtime, all of which can affect their budget unexpectedly. However, the scalability offered by cloud platforms allows SMEs to expand their IT resources in proportion to business growth, preventing overinvestment in the early stages and helping to maintain cost control.

RQ5: What business operations are affected by the adaptation of cloud computing, and what are the most impacted business operations?

Cloud computing enhances several key business operations within SMEs, particularly in data management, customer relationship management (CRM), and supply chain operations. Cloud platforms allow SMEs to centralize their data, providing better accessibility, improved data security, and easier compliance with regulations. In customer relationship management, cloud-based CRM tools enable SMEs to deliver more personalized services, engage more effectively with customers, and improve response times. Furthermore, cloud solutions offer greater visibility and control over supply chains, helping businesses reduce inefficiencies and optimize inventory management. As a result, cloud adoption significantly impacts a range of business processes, leading to better overall performance and operational efficiency.

This systematic review demonstrates the significant impact of cloud computing on the performance of small and medium-sized enterprises (SMEs), underscoring its role in enhancing business efficiency, scalability, and competitiveness. Cloud adoption improves operational performance, supports cost-effective scalability, and drives revenue growth, which aligns with the advantages highlighted in existing research on cloud technologies for SMEs with limited resources. A notable contribution of this review is the introduction of regression models, offering a deeper understanding of the relationship between cloud service usage and key economic indicators, strengthening the argument for cloud computing as a transformative tool for SMEs. However, certain limitations exist, such as small or unspecified sample sizes and geographic concentration, which could affect the generalizability of the findings. Moreover, the predominant use of quantitative methods leaves out qualitative insights, such as user experiences and cultural shifts, and the lack of long-term studies makes it difficult to fully assess the lasting impact of cloud adoption on SME performance.

The implications of these findings are critical for both practice and policy. SME owners should prioritize cloud computing adoption to enhance their business performance, while policymakers need to address barriers like cost and security concerns by implementing supportive measures, such as financial incentives and regulatory frameworks, to foster wider adoption. Future research should focus on filling the gaps by conducting long-term studies and incorporating qualitative methods to capture a broader perspective. Expanding the research to include more diverse geographic regions will also help build a more comprehensive understanding of how cloud technologies can drive sustainable growth and innovation in SMEs globally.

5. Conclusions

This systematic literature review sought to address the critical research gap in understanding the impact of cloud computing on the performance of small and medium-sized enterprises (SMEs). Despite the growing adoption of cloud technologies, there remains a necessity for exhaustive analysis

focused on the specific benefits and difficulties faced by SMEs, especially in developing regions. The key contributions of this work incorporate the identification of the operational and financial factors that substantially influence cloud computing adoption, the comparative analysis of several cloud service configurations across different industries, and the demonstration of how cloud computing can improve operational efficiency, scalability, and business growth. By systematically reviewing and analyzing 90 studies, this research emphasizes the cost efficiency, reliability, and scalability of cloud services while acknowledging the concerns related to cost and security. However, the adoption of cloud computing is justified as an essential step towards enhancing business performance, especially for SMEs with limited resources. The importance of this research lies in its ability to inform researchers, policymakers, and stakeholders about the potential of cloud computing to furnish sustainable and competitive advantages in areas facing significant business challenges. The outcomes propose that while cloud computing provides substantial benefits, there are still obstacles to be addressed, such as cost implications and security concerns. Looking ahead, future research should focus on optimizing cloud service configurations to further enhance security, cost-effectiveness, and integration with emerging technologies. Additionally, there is a need for continued innovation in financing models and policy frameworks to support the wider adoption of cloud computing in regions with the greatest need. As cloud technologies continue to evolve, so will the opportunities to enhance the performance and resilience of SMEs globally.

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