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Original Article

A Systematic Review of the Business Challenges and Opportunities of Enterprise Cloud Computing Adoption in E-Commerce

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Abstract *- Cloud computing has revolutionized business, enabling businesses, particularly e-commerce, to deliver excellent customer service. The significant increase in competitive and persistently progressing business environment has necessitated e-commerce to adopt this modern transformative technology. However, adopting this current technology by e-commerce to advance their business in terms of operation and value comes with numerous business opportunities and challenges. This study adopted the PRISMA protocol to systematically analyze the literature on the potential business opportunities and challenges of enterprises adopting cloud computing in e-commerce. The findings showed numerous potential business opportunities and challenges mitigating enterprise cloud computing adoption in e-commerce. The study suggested practicable solutions to the challenges that will enable smooth integration of cloud-based e-commerce for a successful and blooming performance in the dynamic market if implemented.*

Keywords *- Enterprise cloud computing, Business Challenges and Opportunities, E-commerce.*

1. Introduction

Due to the advent of advanced technologies, the Internet has been a major transformative platform for businesses, from conventional physical retail locations to E-commerce stores. [1].Using digitalization or the Internet in business operations is known as E-commerce [1]. These advanced technologies, especially cloud computing and digitalization, have revolutionized business 'modus operandi' in terms of communication and flow of information. The need for businesses to cater to consumers' pressing needs and preserve market relevance steered them to adopt cloud computing to reinforce and complement their adopted e-commerce [2]. Cloud computing is a technological platform where users can access, use and pay for hardware and software resources on the Internet. It uses cloud-based servers and networks for data storage and accessibility [69]. It provides scalability, easy accessibility, cost-effectiveness and flexibility to users [69]. E-commerce involves transactions for purchasing and selling goods and services on the Internet. It primarily entails Business-To-Business (B2B) and Business-To-Consumer (B2C) models [68]. Cloud computing has established a good background and blueprint for e-commerce by providing scalability and virtualization in resource utilization on the internet. This paradigm shift gives businesses the leverage to employ the benefits of modern technologies in simplifying their routine operational procedures and fostering sustainable growth [3]. Being widely accepted as the next paramount revolution in the IT sector, cloud computing has been exceptionally accepted and endorsed in e-commerce, positioning this sector for giant strides, unprecedented growth, innovation and expansion [3]. The springing up of cloud computing has provided a harmonious and flawless environment for collaboration, resource distribution and productive interaction among e-commerce businesses for sustainable and innovative growth [2]. The advantages of cloud computing to e-commerce cannot be overemphasized; it offers reformed data analytics, reduced operational costs, and excellent scalability and customer support facilities [4]. This gives e-commerce the leverage to optimize their supply chains, customize their market approach and react quickly to market variations without jeopardizing performance and efficiency [4]. However, despite these benefits of cloud computing to e-commerce, numerous challenges such as security, data privacy regulation, integration intricacies, high costs of migration and operation, global access and connectivity, and reliability affect its adoption [5]. In addition, the recent regulatory conditions for data protection and transfer across different borders pose another complexity and challenge for businesses operating in multiple jurisdictions to embrace cloud computing [6]. Despite the aforementioned transformative positive outcomes and opportunities of e-

commerce cloud integration, limited literature addresses both business opportunities and the difficulties of cloud-based e-commerce. Most existing literature narrowly focuses on cloud security and threat, performance, protection, and threat mitigation strategies. This limitation creates a critical research gap that results in uncertainty in decision-making on how enterprises can work through the challenges of cloud computing adoption to make cloud computing decisions by optimizing the full benefits and opportunities of cloud computing. Looking at the present and future advantages of cloud-based e-commerce, there seems to be a pressing need to systematically review the difficulties and benefits of adopting cloud computing by e-commerce. This review will provide a full understanding of the business benefits and drawbacks of adopting cloud computing technology, enabling e-commerce to improve its adoption strategies and overcome the adoption challenges. A thorough understanding of these challenges and opportunities is crucial, enabling e-commerce businesses to fully utilize the advantages of cloud computing and maneuver the challenges of cloud computing adoption to make decisions pivotal to the growth and progress of their businesses [7].

Research evidence exists on various aspects, such as prospects, challenges, and factors affecting cloud technology adoption by countries, SMEs, and sectors such as education and industry [8], but limited studies on the business opportunities and obstacles to enterprise incorporation of cloud computing in e-commerce. This paper will add to the current knowledge by combining and harmonizing the existing knowledge of the business opportunities and drawbacks to enterprise incorporation of cloud computing in e-commerce. Clarifying these adoption opportunities and barriers will allow consultants, policymakers, researchers, and professionals to enable decision-making to promote this transformative cloud technology in e-commerce.This paper, which focused on the systematic review of previous research on the business challenges and opportunities of enterprise cloud computing technology incorporation in e-commerce, aims to unravel the understanding of the business opportunities and barriers to enterprise adoption of this cloud-based technology in e-commerce to adopt strategies and intervention for cloud computing by e-commerce. The study aims to provide to address the following questions

- What are the business opportunities of enterprise cloud computing adoption in e-commerce?
- What are the business challenges of enterprise cloud computing adoption in e-commerce?

2. Related Works

2.1. Types of E-commerce

Several researchers have identified five different categories of cloud-powered e-commerce. The classification is based on their licensing model, sales situation and data interchange of e-commerce enterprises (Table 1)

Table 1. Categories of cloud-based E-commerce

Licensing Model	Sales Situation	Data Interchange
Locally hosted E-commerce	Business-to-Consumer (B2C)	Integrated E-commerce
Software-as-a-Service E-commerce	Business-to-Business (B2B)	Integrated E-commerce
Open source E-commerce platforms	Consumer-to-Business (C2B) Consumer-to-Consumer (C2C)	Integrated E-commerce

[Source: 2]

Business-to-Business (B2B) and Business-To-Customers (B2C) face many challenges affecting productivity, competitiveness, and delivery. Some challenges are common to all e-commerce, while others are specific. The common challenges are infrastructural issues related to internet and connectivity speed, limited technological knowledge and skills among targeted customers, and the need for essential facilities such as reliable warehouses and good transportation networks [72]. Another challenge is regulation connected to the protection and confidentiality of customers' information and purchase rights [73]. Customer-related challenges include lack of proper product awareness [74], accessibility and availability of products [75] and product affordability [76]. Specifically, the primary challenge of B2B is complex transactions that cut across orders, pricing, and negotiations. Selco Builders Warehouse used a streamlined process to simplify the purchase of their contractors [77]. At the same time, B2C strives to solve the problem of prompt and efficient delivery of products during peak purchasing periods [78]. Inter-boarder transactions are also a challenge for cross-border e-commerce due to complexity; China's cross-border e-commerce is being affected by these complex trans-border challenges [79]

2.2. Cloud Computing Models

There are three major cloud technology models offered by cloud computing to e-commerce: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS) [Figure. 1]

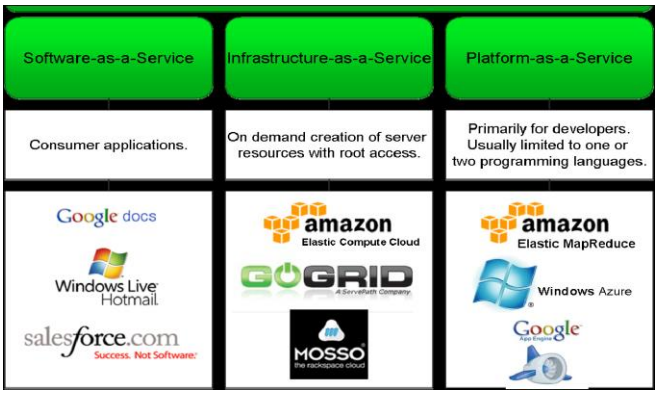

Fig. 1 Cloud computing technology models. [80]

Software-as-a-Service (SaaS) employs utilizes the internet to allocate software to e-commerce cloud users, enabling them to access applications and data storage facilities on the internet without going through the stress of installing physical gadgets [10]. Platform as a service (PaaS) establishes a platform for seamless application launching, maintenance and deployment to e-commerce cloud users [11]. Infrastructure as a service (IaaS) provides cloud online users with virtual hardware and software resources. This enables e-commerce to scale through the costs of purchasing servers, data centers, computer hardware and space [12]. Another new model applicable to e-commerce is Container as a Service (CaaS), which establishes an environment for initiating, operating and monitoring containerized applications for e-commerce cloud users [18].

2.3. Cloud Computing Trend in E-commerce in the Post-2020-Era

Cloud computing has been a transformative technology for e-commerce over the years. Nevertheless, the cloud computing world keeps evolving with new technologies to mitigate the identified challenges of global adoption and usage of cloud computing. New trends that make cloud computing beneficial to e-commerce in terms of efficiency, adaptability, and competitive advantage in the post-2020 era have been invented. These trends include:

2.3.1. Edge Computing

The paradigm of edge computing as being [57] is a recent cloud model that concentrates data processing closer to the network edge. The concept of edge computing is to shift cloud computing to the data's point of origin and enable cloud providers to transfer the workloads and active tasks from various applications to the cloud edge, thereby reducing latency and efficiency and accelerating the transfer of data [57]. Edge computing enables the storage and processing of e-commerce data at the point of generation near the network edge without interfering with the cloud computing platform [58]; this offers quick data response and processing, closer interaction with users, improved intelligent applications and improved data transmission. Also, the glitches and risks associated with e-commerce data uploading to the cloud are minimized with edge computing since it handles data processing locally; this ensures data security, privacy and integrity, which are complicated with traditional cloud computing [58]. The massive cost of uploading e-commerce data to the cloud is eliminated with edge computing since it uses less bandwidth. This gives edge computing an edge over cloud computing regarding energy efficiency and operational expenses [59]

2.3.2. Hybrid and Multi-Cloud Strategies

A blend of private and public clouds in a single cloud model, which enables businesses to optimize the usage of each cloud, constitutes a new cloud computing trend known as the hybrid cloud model [60]. The private cloud is widely known for its security advantage and is used for sensitive data requiring high security. In contrast, the public model is widely used for less sensitive data but is highly scalable and cost-efficient. The hybrid cloud allows e-commerce to navigate through the two cloud models for their specific advantages: The private cloud is often used for storing confidential data, and the public cloud is for large-scale web hosting [61]. The multi-cloud approach entails utilizing multiple cloud providers for various business needs to improve business efficiency, productivity and reliability as tasks are distributed to different cloud providers to avoid service disruption and ensure continuous service delivery [60]. The primary benefit of these strategies to e-commerce is business versatility. E-commerce can select and use any cloud model of their choice based on their timely and immediate needs, and they also give room for e-commerce to take advantage of the best services offered by different cloud providers for their specific needs [60]. For example, Google Cloud efficiently uses data analytics, while AWS offers the best machine learning features [60].

2.3.3. Adoption of Containerization

Containerization is an efficient technology that has modernized how software is deployed and developed [62]. Containerization enables efficient packaging and delivery of applications across different cloud platforms, edge and IoT [63]. Adopting containerization technologies in e-commerce eases the activation and operation of applications, which enables consistency and makes it easier to move applications between different e-commerce cloud models, thereby ensuring efficient security, scalability and a faster rate of application load times [64].

2.3.4. Artificial Intelligence and Machine Learning Cloud Incorporation

Automation in cloud computing technology is to enhance decision-making in e-commerce and will solely make use of artificial intelligence and machine learning from 2020 and beyond. Machine learning and artificial intelligence foster automation for routine, repetitive tasks on a large scale better than non-automated cloud computing [66]. The automation processes in e-commerce entail utilizing innovations like artificial intelligence and machine learning to manage business infrastructure, deploy business software and simplify e-commerce hybrid and multi-cloud environments [67]. This fosters faster business operation, efficiency and accuracy.

2.3.5. Disaster Recovery as a Service (DRaaS)

This new cloud-based technology provides highly reliable, efficient and affordable disaster recovery for SME businesses, including e-commerce [65]. It is a promising future cloud technology that ensures no loss of e-commerce data and activates quick data recovery by utilizing cloud protocols such as iSCSI to copy database transactions. DRaaS ensures e-commerce stability and continuity through

reliable data protection and provides continuous and smooth e-commerce business operations [65].

2.4. E-commerce Cloud Security Vulnerability and Mitigation Strategies

Adopting cloud computing as a transformative agent in e-commerce offers many opportunities and benefits. According to [81], this adoption comes with new security risks and vulnerabilities that injure customers' sensitive and vital information. Therefore, [82] emphasized that as e-commerce depends on cloud computing, reliable strategies must be implemented to protect this information to attract and retain customers.

2.4.1. Data Breaches

The data breach in e-commerce cloud computing refers to the unpermission of access to sensitive customer data, including sensitive financial information [83]. It endangers the reputation of e-commerce and results in capital loss [84] as well as customers [85] and a potential decline in product prices [86]. These damages posed by data breaches create a persistent need for e-commerce to protect cloud data. It was reported that a data breach launched in 2013 exposed about 40 million credit cards and about 70 million customer names, addresses, contact numbers and emails [87].

2.4.2. Insider Threats

These refer to significant risks to e-commerce cloud security arising from organizational staff due to their malicious or careless actions. Individuals may be employees, contractors, or business stakeholders [88]. These insiders misuse their access deliberately or accidentally, leading to e-commerce challenges such as business disruptions, data leakages and financial loss [89, 90].

2.4.3. Distributed Denial of Service (DDoS) Attacks

This is used to describe dangerous attempts to the normal function of a cloud system through malicious traffic to congest the e-commerce servers or networks, causing inactivity of the cloud. This congestion often causes resource overloads, making it unavailable or giving slower responses to users since the cloud applications are designed with a specified threshold of activities [91].

2.4.4. Identity Theft

This refers to a security risk of e-commerce customers' accounts in the cloud; this occurs when hackers gain access and hijack customers' accounts, leading to harmful actions such as stealing customers' identities, data manipulation and service disruption [92].

2.4.5. Malicious Code Injection

Malicious code injection, known as malware injection, occurs in the cloud system of e-commerce when attackers insert harmful code into the cloud system to damage the security and trustworthiness of e-commerce cloud data and services. This malicious injection weakens and takes advantage of the weakened cloud system, impacting many users [34]. The strategies for mitigating these security vulnerabilities include implementing a strong encryption code system, which is critical in protecting against cyberattacks within the e-commerce cloud by encrypting sensitive data and turning them into a secured format inaccessible to unauthorized users. This ensures data safety and privacy, preventing it from interception, manipulation and theft [94]. Similarly, e-commerce can use Multi-Factor Authentication (MFA) to help e-commerce enforce and restrict unpermitted access and insider threats and protect data from breaches [40].

Furthermore, the practice of regular security auditing, which entails access routes checking, system settings and security measures to identify potential weaknesses or unusual activities, is essential for reducing cyberattacks in the e-commerce cloud [93] and, finally, effective use of Application Programming Interfaces (APIs), which entails the use of strong authentication, authorization and accessibility methods such as OAuth and data encryption during data transmission are effective in preventing cloud attacks such as Dos or code injection [41]. Practical and Properly designed APIs protect e-commerce from unauthorized access, data breaches and other security vulnerabilities that can affect e-commerce cloud-based information [98].

2.5. Theoretical Framework

The Unified Theory of Acceptance and Use of Technology (UTAUT) and Technology-Organization-Environment framework were selected for the theoretical framework of this review. The UTACT focuses on performance, social impacts, and enabling factors as indicators of technology acceptance [55]. At the same time, the TOE framework explains the benefits of technology use and adoption in terms of technology, organization, and environment [56]. The application of UTAUT to business opportunities and challenges of enterprise cloud computing technology incorporation in e-commerce are reflected in factors such as user's acceptability of cloud provider efficiency, while TOE examines the cloud computing technology integration in terms of scalability, protection, business size, resources and supports

3. Materials and Methods

The research adopts a qualitative approach to synthesize and analyze previous articles on business challenges and opportunities of enterprises integrating cloud technology in e-commerce. The research employed recent literature from online databases practicable and suitable resources for reviewing the business challenges and opportunities of enterprise cloud computing adoption in e-commerce. Databases used as the main data sources are ScienceDirect, SpringerLink, ACM DL and IEE explore.

Table 2. Summary of database query strategy

Database/Sources	Search Terms
ScienceDirect, SpringerLink, IEEE explore, ACM, DL and Google scholar.	Enterprise cloud computing adoption in e-commerce opportunities and challenges. OR Enterprise cloud computing adoption in e-business adoption benefits and challenges. OR Cloud computing adoption in e-business adoption benefits and problems. OR Enterprise cloud computing adoption in e-commerce adoption advantages and issues. OR Challenges of problems and opportunities or benefits of cloud computing adoption in e-business or e-commerce.

These databases were chosen for their eligibility in sourcing and providing articles from multiple compilations of academic journals. They also allow researchers to select suitable articles that provide answers to the research questions [13]. Google Scholar screened the articles for search terms, keywords, and phrases. Articles from peer-reviewed journals published from 2017 through 2024 were searched to emphasize the most current literature related to the topic. Terms included in the searches are e-commerce, business opportunities, business challenges, and enterprise cloud computing adoption. Alternatively, words synonymous with the search terms were used for better results. The alternative synonyms include e-business, business issues or problems, business advantages, and SME cloud computing acceptance. The search process incorporated Boolean operators 'AND' to combine different terms to form one keyword search. Also, the "OR" operator was used as an alternative to the search words (Table 2). The articles were screened and selected to meet inclusion and exclusion criteria. The screening process is restricted to peer-reviewed articles published between 2017 and 2014. Outdated articles were not considered because of the constantly evolving nature of cloud computing. Only the most recent articles were included in the screening process to ensure that accurate and updated conclusions about business opportunities and challenges of adoption of cloud computing in e-commerce were drawn from the review. Bias during the review process was minimized by developing well-structured research questions before the database search and minimized by cross-referencing to avoid partial conclusions, considering only articles published in English and peer-reviewed. All opportunities and challenges were considered. The identification, screening and selection procedure for the identified 13 appropriate articles are shown in the PRISMA flowchart in Figure 2. Relevant data was recovered from the selected literature with Microsoft Excel; information retrieved from the relevant data includes authors' names, research titles, research aim, research methodology, and findings.

Around 428 studies were found from searches across all four databases initially after applying search filters. These results only show a rough estimate with duplicate studies included. The review of [70] and [71] had a rough estimate of 2,774 and 52 430 articles, respectively, initially, but were later streamlined to 44 and 127 articles suitable for analysis by PRISMA. Using PRISMA helps researchers improve transparency and avoid unnecessary reading by focusing on studies that genuinely contribute to the research [71] After collecting the 428 studies, 289 duplicates were found and removed, leaving 139 studies. An additional 40 studies were excluded based on ineligibility, leaving behind 99 studies for article retrieval. Only 53 studies were retrieved and reviewed based on their abstracts and findings.

Any studies that did not mention enterprise cloud computing technology incorporation in e-commerce or business opportunities and challenges in the abstract or key findings were excluded to avoid bias and ensure that only relevant studies totaling 13 were included for the full study review. Qualitative thematic analysis of themes from the articles was adopted to identify the current business opportunities and difficulties limiting cloud computing technology integration in e-commerce. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) are mapped out to ensure explicit and dependable results of systematic reviews and meta-analyses [14]. PRISMA provides a simpler and more reliable means of ensuring an open systematic review [15]. (Figure 1)

3.1. Ethical Considerations

Since systematic reviews rely solely on secondary data from reputable journals, they require less ethical consideration. The issue of plagiarism was avoided by giving full credit to the authors and secondary data from the articles. The principle of reliability, integrity, and trustworthiness was ensured in the study. Articles used for this study were obtained from reliable, credible, and freely accessible databases.

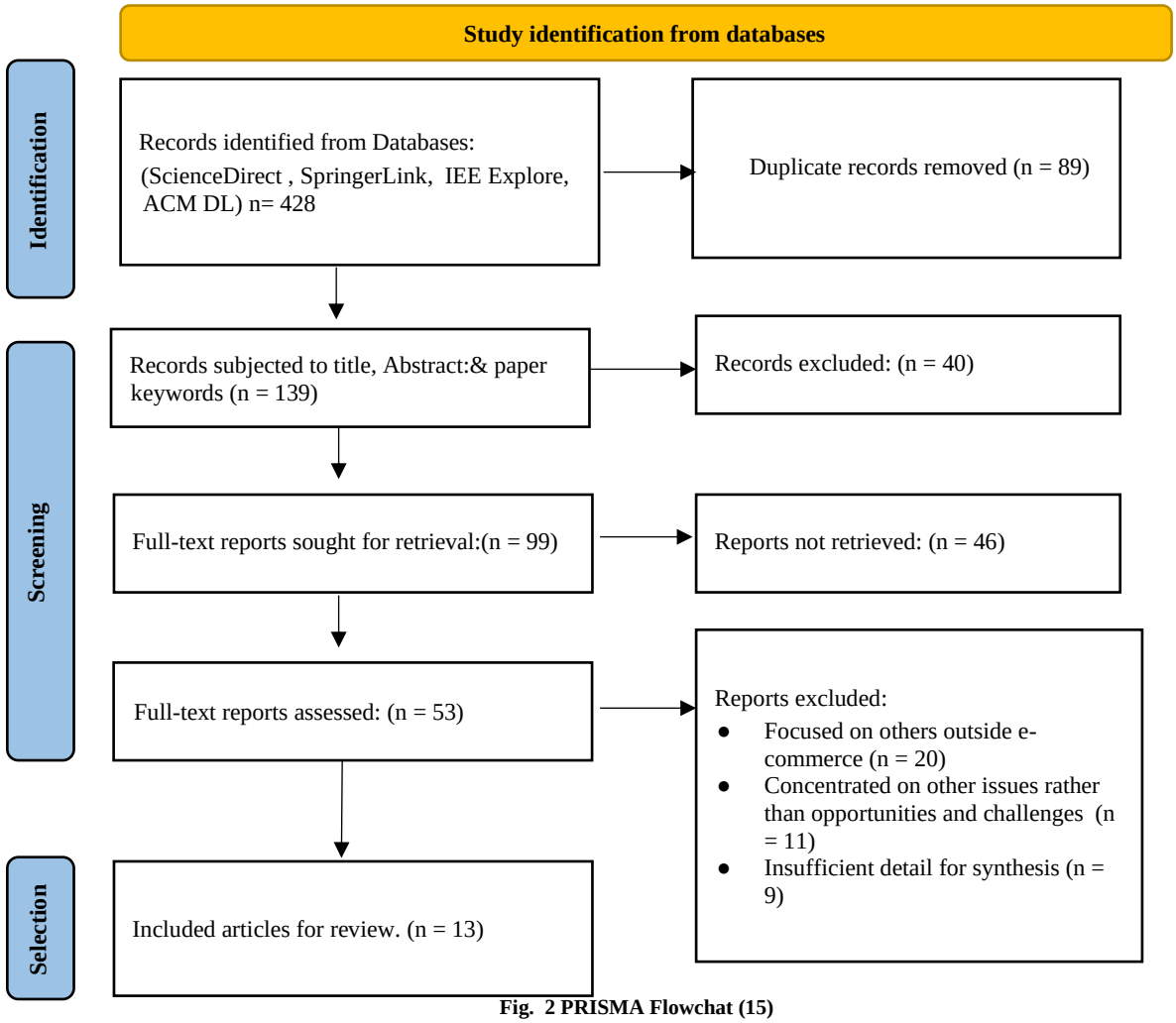

Fig. 2 PRISMA Flowchat (15)

The accurate report of studies from peer-reviewed journals ensured the credibility of this study [16]. PRISMA's emphasis on transparency and copiability ensured adherence to PRIMA's guidelines for reliable, impartial, and trustworthy systematic reviews.

4. Summary of Key Findings

A total of 13 articles meeting this review's inclusion criteria were finally selected and included (Tables 3 and 4). (Figure 3)

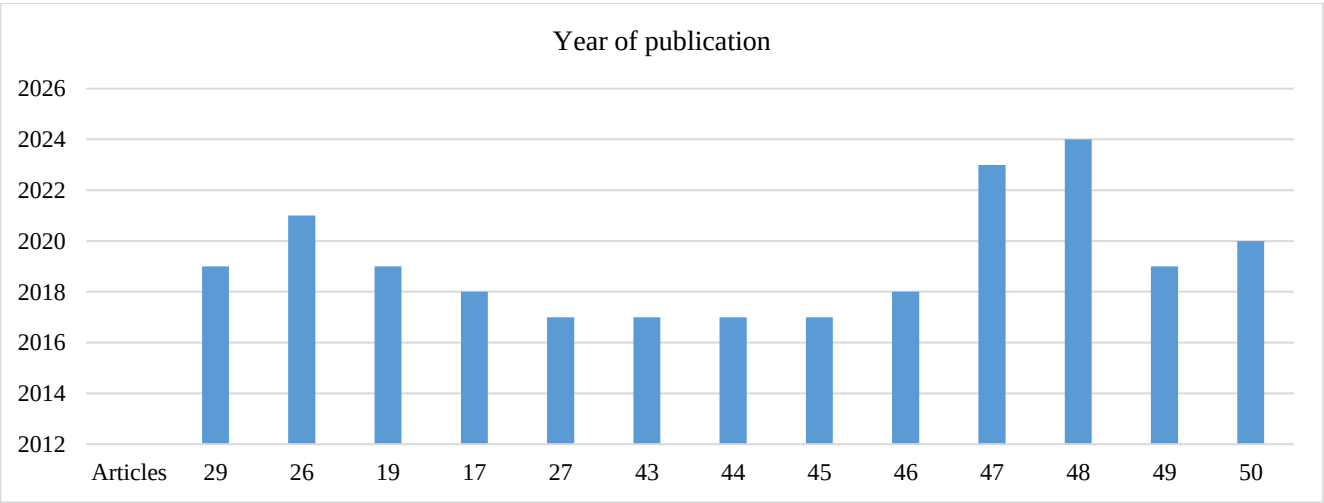

Fig. 3 Details of reviewed article

Table 3. Quality Assessment Criteria (QAC)

S/N	Quality Assessment Criteria	Rating Scale
1	Does the study concentrate on the specific area of research?	Yes=1, NO=0, Partly=1
2	Does the study focus on enterprise cloud computing adoption in e-commerce?	Yes=1, NO=0, Partly =1
3	Does the study focus on business opportunities of enterprise cloud computing adoption in e-commerce?	Yes=1, NO=0, Partly =1
4	Does the study focus on the business challenges of enterprise cloud computing adoption in e-commerce?	Yes=1, NO=0, Partly =1

Table 4. Summary of key findings from selected articles in the Data extraction table

Author(s)	Title	Aim	Study Design	Key Findings
[29]	Smart e-commerce systems: current status and research challenges	To explore the main drivers behind the growth of smart e-commerce systems, including IoT, social media, mobile internet, big data analytics, and cloud computing.	Quantitative and Qualitative	Robustness, complexity, breach of data privacy, and reduced data quality were identified as challenges associated with smart e-commerce systems.
[26]	Cloud Computing based E-commerce Management On Transaction Security Concepts.	To analyze the effectiveness of the designed Cloud Computing E-commerce Management System (CCECM).	Qualitative.	1. E-commerce management using cloud computing enables improved evaluation and decision-making strategies related to e-commerce security. 2. CCECM stops the danger of data loss associated with e-commerce and enables accuracy in policy making and result discussions.
[19]	The economic advantages of adopting cloud-based e-commerce for SMBs in India's service sector.	To analyze the economic impact of cloud-based e-commerce on Indian SMBs.	Qualitative.	The identified benefits are affordable operational costs, lower cost of assets and prompt accessibility to software and hardware.
[17]	Contributing factors to cloud computing adoption in e-commerce in developing nations and implications for Indonesia.	To analyze the key factors impacting the adoption of cloud computing for e-commerce in developing countries.	Qualitative.	The identified benefits of e-commerce are additional financial value, improved business modus operandi, and improved customer service. The challenges are noticed in terms of security, customers' consent, and stakeholder support.
[27]	Cloud computing Adoption: A short review of issues and challenges	To review and analyze related issues and challenges associated with e-commerce adoption of cloud computing.	Qualitative	The identified challenges of adopting cloud computing in e-commerce included security concerns, accessibility problems, data limitations, regulatory challenges, service provider selection issues, and technological delays.
[43]	Assessment of Cloud Computing in E-Commerce Applications	To evaluate the difficulties in adopting cloud computing for e-commerce.	Qualitative	The analyzed barriers are security, business size and type, economic value, infrastructure, political and legal issues, cloud computing ecosystem and customer satisfaction.
[44].	Study on the E-commerce Performance of SMEs Utilizing Cloud Computing Platforms	To study the factors that affect the performance of cloud-based e-commerce operations.	Qualitative	The performance challenges are data security and privacy, organizational size and category, and cloud technology framework.

[45]	Investigation of E-commerce security evaluation using a combined weighing method in cloud-based environments	To evaluate the security situation of ecommerce under a cloud computing environment	Quantitative	Security and cloud computing environment are the key obstacles to e-commerce utilizing cloud computing infrastructure.
[46]	Influencing Elements for Cloud Computing Integration in Small and Medium E-Commerce Enterprises in Jordan	To study the significant factors influencing cloud computing integration in e-commerce SMEs	Qualitative	The findings highlighted that the main challenges to cloud computing adoption are business demands, cost concerns, security, and reliability.
[47]	Cloud Computing Technology in Development E-Business (Literature Review)	To assess the positive impacts of adopting cloud computing in E-business	Qualitative	The benefits are reduced operational cost, data recovery, accessibility, flexibility and enhanced operation speed.
[48]	Cloud computing empowering e-commerce innovation	To examine how cloud computing is transforming innovation in e-commerce	Qualitative	The benefits are collaboration and integration, innovation and experimentation, environmental impact reduction, financial benefit, scalability, data backup, advanced data analysis and customization.
[49]	Cloud-Enabled E-Commerce	To investigate the potential benefits and barriers of Cloud Computing in E-commerce and suggest a suitable E-commerce framework based on cloud technology.	Qualitative	The benefits were lower cost, scalability, accessibility and easy management. Security and privacy, connectivity, reliability, data storage and service information issues were the challenges.
[50]	E-Business Data Processing System Implemented In Cloud Computing	To analyze the role of cloud computing in e-commerce and its implementation in managing enterprise e-commerce operations	Qualitative	The contributions of cloud computing to e-commerce management were flexibility, efficient security, data processing ability and economic value. The challenges were security, cost, cloud computing environment and data storage.

Table 5. Key findings on opportunities of enterprise cloud computing adoption in E-Commerce

S/N	**Theme on Opportunities**	**Supporting Authors**
1	Economic and financial value	[19],[17], [47], [48], [49]
2	Improved customer services	[17]
3	Easy scalability and improved performance	[17], [48], [49]
4	Improved decision making	[26]
5	Data accuracy, security and backup	[26], [47],[48]
6	Accessibility and availability	[19], [47], [49]
7	Flexibility	[47],[50]
8	Business speed and agility	[47],[48]
9	Infrastructure	[48]
10	Advanced analytics and personalization	[48]
11	Improved collaboration and Integration	[48]
12	Excellent innovation and experimentation	[48]
13	Environmental impact limitation	[48]
14	Easy management	[49]
15	Excellent data processing ability	[50]

Table 6. Key findings on challenges faced by enterprises in adopting cloud computing for e-commerce

S/N	Theme on Challenges	Supporting Authors
1	Security and privacy	[43],[44],[45], [46],[29], [17], [27], [49],[50]
2	Connectivity and open Access	[27], [49]
3	Enterprise type, need and size	[43], [44], [46], [29]
4	Stakeholder support	[43]
5	Political, Regulatory and legal issues	[27], [43]
6	Customers' satisfaction and acceptance	[17],[43]

5. Discussion of Key Findings

Cloud computing is one of the evolving technologies that provide transformative opportunities to e-commerce in terms of productivity, success, and growth. However, its adoption is still mitigated by numerous challenges identified in previous research [48]. The findings from this study revealed numerous business opportunities and barriers to implementing cloud computing in commerce enterprises to answer the following research questions: What are the business opportunities for enterprise cloud computing technology integration in e-commerce? What are the business obstacles to enterprise cloud computing integration in e-commerce? The findings from this study identified revealed seventeen (17) business opportunities for this adoption. The economic and financial value theme comprises affordable operational and lower asset costs.

Economic opportunities offered by the implementation of cloud computing in e-commerce can be explored by an enterprise through financial value generated through a reduction in the cost of physical infrastructures, in the cost of the asset from some basic quality of cloud computing architectures, such as self-service on demand, rapid adaptability, resource pooling, and broad network access [17,19, 47,48,49]. The incorporation of cloud computing technology in e-commerce is beneficial in lowering operational costs compared to the conventional method, and this is supported by the study of [19], which recorded a remarkable reduction in operational and asset costs as a result of the incorporating cloud technology services offered by Amazon Web Services by some Indian service small to medium businesses (SMBs). This reduction due to limited IT platforms, which raises expenditure via purchase and maintenance, has led to increased access to the market and productivity. The lower cost of cloud computing maximizes profits and enables enterprises' survival in the ever-dynamic e-commerce environment. The theme of scalability and improved performance is highlighted in the study as crucial for enterprises as it makes them appealing in terms of cost and resource optimization [17, 48, 49].

Scalability improves the performance and adaptability of enterprises of all sizes adopting cloud computing in e-commerce to fluctuating resources and congestion of customers' applications {20, 21]. The flexibility benefits offered by scalability provided by cloud computing ensure its compatibility with all business enterprises [21] and adaptation to dynamic business environments [49].The review findings showed that accessibility and availability are essential opportunities cloud computing offers e-commerce enterprises [19,47,49]. Cloud computing is accessible and available on any smartphone and internet-enabled devices, enabling customers and clients to access services and products offered by enterprises [49]. Data accuracy, security, and backup describe the business opportunities of enterprise cloud computing adoption in e-commerce [26, 47, 48]. Since businesses rely on IT to store information, these IT are prone to virus attacks, manipulation and data loss, damaging the reputation of the information stored by enterprises over the years. [26]. Using cloud computing technology to store enterprise data ensures its security, accuracy, and retention. Business flexibility and dexterity are also enterprise cloud computing opportunities [47, 48, 50]. The excellent backup advantage of cloud computing is laudable due to the ease of storing data in several locations to guarantee security, protection and data recovery [48, 53]. The flexibility enables enterprises to access the cloud technology irrespective of their resources, itinerary and financial strength. [48, 50]. Additionally, the speed of enterprises is improved by cloud computing, which makes services and production quicker than the conventional way of operation. This agility is possible due to the versatility of the infrastructure provided by the cloud model, which can add, move and change enterprise applications based on needs [47].

The findings from the review also revealed that improved customer service and decision making, infrastructure and analytics and personalization are great opportunities offered by cloud technology incorporation in e-commerce enterprises [17, 26, 48]. The adoption of cloud computing in e-commerce builds the capacity. It enables enterprises to advance in their customer service, which they would not have achieved due to technological difficulties, limited professionals, and cost limitations when using conventional methods pivotal to customer service e-delivery [17]. Similarly, the global competition for productivity in e-commerce makes it unarguably important for enterprises to adopt advanced technologies such as cloud computing to remain competitively relevant. The major persistent issue to be addressed by these global enterprises is the multi-criteria decision-making (MCDM) challenge. The study of [26] revealed a suitable approach to the cloud model that aids decision-making, prevents data loss risks and enhances result

analysis to this challenge. This is Cloud Computing- based E-commerce Management (CCEM).

The approach identifies SaaS as the optimal solution to this challenge and other challenges, such as business needs, and applies to small- to medium-sized e-commerce enterprises [26, 52]. The findings of [48] also revealed that cloud computing technology implementation in e-commerce enables excellent customer service and experiences in steering through network congestion with ease and attends to versatile customer requests through progressive customization and analytics to enable excellent service delivery. Furthermore, [48] emphasized that incorporation, partnership, experimentation, creativity, and environmental pollution reduction are excellent opportunities offered by cloud computing adoption in e-commerce. Cloud computing enables collaboration with cloud third-party services such as PaaS, SaaS and IaaS for efficient incorporation, simplifying enterprise business operations and improving customer satisfaction and business growth. Implementing cloud computing technology in e-commerce creates a platform for innovations, new ideas and insight, which allows enterprises to keep up with competition in a rapidly transforming market [48]. Incorporating cloud computing in e-commerce helps enterprises minimize environmental pollution and have an eco-friendly environment due to reduced energy usage [48]. This also ensures the proper monitoring of the enterprise environment and drives a more sustainable, eco-friendly enterprise [54]. Finally, easy business management, efficient security and data processing and economic value are also excellent opportunities identified as themes in themes. Cloud computing empowers e-commerce with excellent data processing proficiency, making enterprises stand out in e-commerce operations [50]. Through a running server, cloud computing can network thousands of computers and gadgets and provide a wide range of data computing and analyzing tools for numerous customers who cannot complete their requests on a single device [50]. This proficiency in data processing offered by e-commerce enables an excellent and simple way of managing business and promotes the economic value of enterprises.

However, the numerous excellent business opportunities embedded in cloud computing and its adoption by e-commerce are limited by several challenges that can be mitigated. The study [17, 27, 29, 43, 44, 45, 46, 49, 50) revealed that cloud security and privacy are the major challenges of cloud technology incorporation in e-commerce. Securing cloud services encompasses data security, privacy, confidentiality and accessibility [24]. The security issue has become a serious worry in the cloud computing environment, and numerous scholars have considered this challenge critical for cloud applications and data [4]. The security of business and technology information stored on the cloud is prone to attacks during data processing or creation due to the accessibility of attackers to the firewall where this information is located on the cloud providers [5].

Recent findings from the research show that developing a lasting solution to this great challenge is a big task for all cloud researchers [7]. Cloud attackers target business processes such as program usage or interactions between cloud providers and users to stop the flow of information or manipulate and destroy data involved in business transactions [7]. Enterprises often feel that security in cloud computing is not guaranteed because of fear of losing or exposing confidential and delicate information due to cloud computing vulnerability. This is why enterprises are unwilling to adopt cloud computing [33]. One of the cloud computing business models involves the distribution of important resources such as data, programs, and storage among cloud customers, which can jeopardize data confidentiality through data breaches caused by careless internet data control policies, data breaches, Denial of Service (DoS), Malware and susceptible control of Application Programming Interface (API) resources [34, 35]. Data confidentiality, integrity, and privacy can be suffered by enterprises adopting cloud computing because data can be archived globally and distributed among cloud users. Researchers have recommended some mitigating strategies for this cloud menace. The study of [34] suggested identity and access management (IAM), which enables users to access the cloud only as one of the means of ensuring cloud security for e-commerce[38, 39]. Encryption and web application firewall (WAF) encryption ensures cloud security by converting stored and processing enterprise data to unreadable format, while WAF controls cloud congestion to ensure cloud security [38, 39, 34, 41 & 42]. Business enterprises' nature, size, and need also limit cloud computing incorporation in e-commerce [29, 43, 44, 46]. The enterprise can be a small and medium enterprise (SME), business-to-business (B2B) enterprises, larger enterprises, customer-to-customer (C2C) enterprises, business-to-customer (B2C) enterprises, e-marketplaces, and mobile e-commerce. Choosing cloud computing in the e-commerce aspect of any enterprise depends on the customers and services rendered by the enterprise. Several researchers have recommended SaaS for SME, C2C and B2C enterprise [30], as it offers a model that fits the enterprise's nature and goal [32] with excellent flexibility and a reduced running cost. Similarly, [36] recommended PaaS and Iaas for larger enterprises such as B2B and e-marketplaces for efficient service delivery to vast and numerous customers [36]. The uncertainty, complexity, and excesses in customers' demand without considering the changing, elaborate, and diverse nature of enterprises adopting cloud e-commerce can impact the robustness of cloud-driven e-commerce and impair the efficiency of the cloud system. For instance 2021, Taobao's online shopping application collapsed due to multiple shoppers trying to cash in during the Chinese BDouble

Eleven shopping festival [29]. Another critical challenge is the cloud computing environment [43, 44, 46, 50].

Issues such as cloud architecture, platform, and cloud application have been extensively reported as challenges to cloud computing adoption. Challenges such as connectivity and open access affect cloud computing adoption by rural e-commerce based enterprises [27, 49]. Several scholars have reported issues such as a shortage of internet facilities and expertise, leading to persistent poor internet connection and restricted internet access [30, 31, 32]. Also, fear of the continual availability of uninterrupted resources and infrastructure has limited the interest and preparedness of enterprises adopting cloud computing over the years [31]. The government should assist rural-based enterprises with uninterrupted internet access and other social amenities pivotal to cloud computing adoption. Furthermore, customer (users) satisfaction and acceptance also affect cloud computing adoption. Factors such as poverty, constrained financial resources, illiteracy and ignorance were reported by [31] as limiting users' adoption of cloud computing. Computer illiteracy, lack of infrastructure such as efficient internet and improper awareness of cloud computing benefits also contribute to these challenges [31 & 22]. Finally, stakeholder support, political, regulatory and legal issues are critical challenges of cloud computing adoption, Government, enterprise, cloud computing, and internet providers, customers, and vendors constitute the stakeholders of cloud computing adoption [27, 43]. Research has established the importance of stakeholders in enterprise cloud computing adoption [23, 24]. They are important to address the stress of enterprises selecting reputable, reliable, sizable, and proficient cloud computing service providers to avoid constant migration from one provider to another, the high cost of migration that influences the readiness and decision of enterprises adopting cloud computing in e-commerce [25&38]. Similarly, since virtualization is a crucial element of cloud computing, the need to regulate data storage, proficiency, quality, and information is highly important. The legislative secures these by proposing and enforcing transaction rules encompassing cloud users' rules, information dissemination rules, and cloud transaction rules within the cloud computing domain [27& 28]. Furthermore, the legal framework underscores rules clarifying ownership between cloud computing providers and users [43]. Another challenge of enterprise cloud computing adoption in e-commerce is the numerous service level agreements (SLAs) that occur among the cloud computing providers and the lack of harmonized SLAs caused by numerous cloud computing resources. These resources are often affected by factors such as selected processors, central processing unit (CPU) centers, and types of bandwidth [43]. Another challenge of implementing cloud computing in e-commerce is the paucity of SLAs, which is critical for cloud computing providers and users in asset distribution and business connections. A guarantee of standardized SLAs among cloud computing providers and enterprises is important to ascertain and induce the implementation of business agreements [28]. Stakeholders of cloud computing adoption are expected to strategically improve their support and collaboration to mitigate this challenge by implementing, monitoring and evaluating programs that will enhance cloud computing adoption in e-commerce.

6. Conclusion

It is quite glaring that cloud computing presents numerous business opportunities such as economic value, affordable operational cost, lower cost of assets, improved business modus operandi, business efficiency and redeploying non-essential activities, improved customer care, and prompt accessibility of software and hardware to e-commerce enterprises.

However, its adoption by enterprises is also mitigated by technological and infrastructural challenges, data security, integrity and quality, stakeholder support, legislative issues, and service level agreement (SLA). This research provides an in-depth examination of the business prospects and obstacles in adopting cloud computing for enterprise e-commerce by reviewing recent literature. It contributes to the e-commerce sector by providing insights into the business challenges and opportunities of e-commerce adopting cloud computing. It also gives cloud providers vital information about the challenges limiting the adoption of their cloud services.

6.1. Limitation

Limited databases were considered for this study due to time constraints and stringent exclusion criteria that might have excluded relevant literature from the review, which constitute the limitation of this study. Further limitations occurred in the year range (2017-2024) used for the study and a limited number of selected articles (13) for the review.

Articles published before 2017 could have been added to the list of opportunities and challenges, and the trend of these obstacles and prospects of cloud computing incorporation in e-commerce could have been reviewed. Future research opportunities can be derived from the findings and limitations of this study. The mitigating strategies and solutions to these challenges can be further researched.

6.2. Future Recommendations

When considering future research insight, the influence of stakeholders' regulatory and legal bodies in cloud computing adoption in e-commerce should be extensively researched.

6.3. Potential Study Biases

Biases are imminent in research to increase trust, credibility and genuineness. The review design bias was minimized using well-structured inconclusive research

questions; location bias was minimized by searching numerous databases for peer-reviewed articles published in English to enable a wide range of sources.

Bias due to selection was limited by ensuring articles were peer-reviewed by authors with clearly defined key concepts to avoid confusion. Finally, bias due to synthesis was minimized by adhering strictly to a set of protocols and considering statistics, methods and findings of all the selected articles. Thematic analysis was also used to analyze common themes from all selected studies.

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