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A narrative literature review on the economic impact of cloud computing: Opportunities and challenges

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Abstract: This paper focuses on assessing the Economic Impact (EI) of Cloud Computing (CC), which has emerged as a powerful technology that can transform business operations and enhance economic growth. This paper employs a narrative literature review methodology to assess the EI of CC, which has emerged as a transformative technology. It begins by examining the economic benefits of CC, including cost savings, improved efficiency, and increased innovation. Subsequently, it explores the challenges associated with assessing the EI of CC, such as data privacy and security concerns, interoperability issues, and the need for new regulatory frameworks. The paper also provides insights into the opportunities and challenges that CC presents for different sectors of the economy, including healthcare, finance, and government. Ultimately, the paper emphasizes the importance of a holistic approach to assessing the EI of CC that considers both its benefits and challenges in order to make informed decisions about its adoption and use.

Keywords: Cloud Computing; business transformation; productivity; cloud service providers; Economic Impact

1. Introduction

Cloud Computing has become a popular technology that enables businesses to improve their efficiency, reduce costs, and enhance innovation. As the technology continues to evolve, its EI has become a subject of great interest to researchers and policymakers alike. Assessing the EI of CC is essential for understanding its potential benefits and challenges and making informed decisions about its adoption and use [1,2]. In this paper, we examine the EI of CC and explore the opportunities and challenges associated with its adoption across different sectors of the economy. We also discuss the challenges of assessing the EI of CC, such as data privacy and security concerns, interoperability issues, and regulatory frameworks. Finally, we provide insights into how organizations can measure the EI of CC and make informed decisions about its adoption and use [3]. The findings of this paper will help the researchers to study the EI of CC and its potential for transforming the way organizations operate. However, the EI of CC is not straightforward. There are challenges associated with assessing its EI, including the need to consider indirect and non-monetary effects such as the impact on employment and productivity [2,3]. Moreover, there are concerns about data privacy and security and interoperability issues to secure the use of CC.

Despite these challenges, CC presents significant opportunities for different sectors of the economy. For example, in the healthcare sector, CC can enable the secure storage and sharing of patient data, while in the finance sector, it can help

organizations to better manage their data and compliance requirements. Similarly, in the government sector, CC can improve the delivery of public services and increase efficiency in the public sector [3]. Worldwide market share of different cloud infrastructure service providers is shown in **Figure 1**.

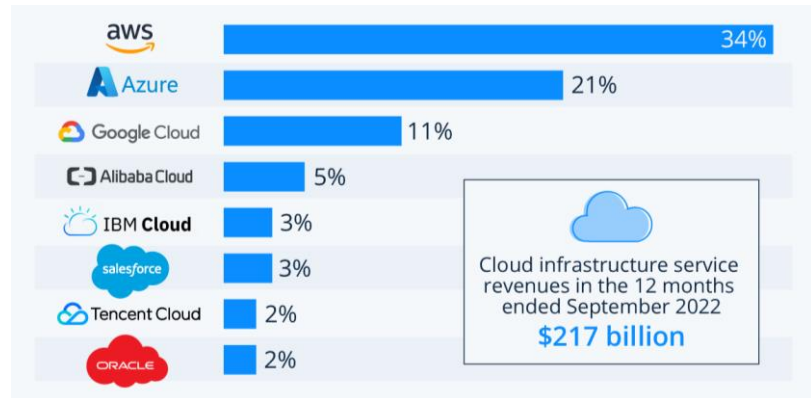


Figure 1. World wide market share of cloud infrastructure service provider.

Source: Statista.

This study employs the narrative literature review methodology, a qualitative approach that synthesizes findings from diverse sources to provide a comprehensive overview of the EI of CC. Unlike systematic reviews, which rely on predefined inclusion and exclusion criteria and often quantitative meta-analysis, narrative reviews focus on thematic exploration and interpretative synthesis. This approach is particularly suited for assessing a broad and evolving field like Cloud Computing, where the focus is on identifying key trends, challenges, and opportunities rather than conducting exhaustive quantitative analysis.

Given the growing importance of CC, it is essential to assess its EI in a comprehensive and systematic way. By doing so, we can better understand the benefits and challenges of CC and make informed decisions about its adoption and use [4,5]. This paper aims to provide insights into the EI of CC and the opportunities and challenges it presents for different sectors of the economy.

1.1. Significance for economic impact on cloud computing

Assessing the EI of CC is significant for several reasons. First, it enables organizations to make informed decisions about the adoption and use of CC. By understanding the economic benefits and challenges of CC, organizations can determine whether CC is a suitable technology for their specific needs and how it can help them achieve their business objectives [1,5]. Secondly, assessing the EI of CC is essential for policymakers who are responsible for regulating the use of CC. Policymakers need to understand the EI of CC to ensure that the technology is used safely and responsibly and that its adoption does not lead to unintended consequences such as job losses or a widening digital divide [2]. Thirdly, assessing the EI of CC is important for researchers who are interested in understanding the broader implications of the technology on the economy. Research on the EI of CC can help to inform public policy debates, contribute to the development of new business models, and provide insights into the potential of CC to transform different sectors of the economy [6,7].

In summary, assessing the EI of CC is essential for organizations, policymakers, and researchers who are interested in understanding the benefits and challenges of CC and its potential to transform the way we do business.

To strengthen the originality of the research, it is essential to incorporate recent studies and primary data to reflect the evolving dynamics of Cloud Computing. For instance, a 2023 Gartner report projects a 21.7% growth in the global public cloud services market, reaching USD 597 billion in 2024, driven by the integration of AI and ML technologies. Similarly, the International Data Corporation (IDC) highlights that enterprises adopting cloud technologies experience an average 25% increase in operational efficiency, showcasing the transformative potential of cloud solutions in enhancing productivity. Additionally, recent primary data from the European Commission's Digital Economy Observatory reveals that small and medium-sized enterprises (SMEs) utilizing cloud services report a 30% revenue increase within three years, emphasizing the technology's role in empowering businesses and fostering economic growth. However, challenges persist, as highlighted by the European Cloud Initiative's findings that 45% of organizations face interoperability and compliance issues during cloud adoption, underscoring the need for standardized frameworks and clearer regulatory guidelines. Looking ahead, studies predict that by 2035, hybrid cloud models will dominate enterprise infrastructure, further amplifying cost efficiencies and innovation potential. Incorporating such recent data and forward-looking insights not only reinforces the relevance of the research but also highlights the critical areas requiring attention for the sustained Economic Impact of Cloud Computing.

1.2. Objective of economic impact on cloud computing

The objective of a paper on assessing the EI of CC is to provide a comprehensive and systematic analysis of the adoption and use of CC. The paper should aim to achieve the following objectives.

- To examine the economic benefits of CC, including cost savings, improved efficiency, and increased innovation.
- To explore the challenges of assessing the EI of CC, including data privacy and security concerns, interoperability issues, and regulatory frameworks.
- To provide insights into the opportunities and challenges that CC presents for different sectors of the economy, including healthcare, finance, and government.
- To discuss the methods and tools that organizations can use to measure the EI of CC and make informed decisions about its adoption and use.

2. Literature review

Cloud Computing has gained immense popularity over the past decade as an alternative to traditional computing [2–5]. This technology allows users to access computing resources and services through the internet, reducing the need for expensive hardware and software infrastructure. As CC continues to grow, there has been a significant interest in understanding its EI [6]. In this literature review, we will explore the EI of CC by examining the latest research in this field.

According to a study by Gartner, CC is expected to generate \$305 billion in revenue by 2021 [7]. This is a significant increase from the \$186 billion generated in 2018. The report highlights that the cost benefits of CC, including reduced hardware and software costs, are driving this growth. A study by the European Commission Joint Research Centre (JRC) examined the EI of CC on small and medium-sized enterprises (SMEs) in the European Union. The study found that SMEs that adopted CC were more likely to experience increased revenue and productivity, as well as improved customer satisfaction [7,8]. The study also found that CC adoption was associated with increased innovation and better access to new markets. Another study by McKinsey and Company found that CC could create up to 3.3 million new jobs in the United States by 2022 [9]. The report highlights that CC can enable organizations to scale up quickly, leading to increased productivity and job creation. The study also found that CC can lead to cost savings of up to 20% for organizations.

A report by the International Data Corporation (IDC) found that the economic benefits of CC extend beyond cost savings. The report highlights that CC can enable organizations to innovate more quickly, improve customer service, and increase employee productivity [10]. The study also found that CC can help organizations become more agile and better able to respond to changing market conditions. In conclusion, CC is having a significant impact on the global economy. Studies have found that CC can lead to cost savings, increased revenue and productivity, job creation, and improved customer satisfaction [8,9]. The economic benefits of CC extend beyond cost savings and can enable organizations to become more innovative and agile. As CC continues to evolve, it will be interesting to see how its EI continues to grow.

2.1. Past literature on different countries economic impact of cloud computing

- United States: CC has had a significant impact on the US economy, with estimates suggesting that the technology has created 1.7 million jobs and generated over \$214 billion in annual revenue [10,11].
- China: The adoption of CC in China has driven economic growth in the country, with estimates suggesting that CC will contribute \$1 trillion to China's GDP by 2025 [9,11,12].
- United Kingdom: A study by Oxford Economics found that the adoption of CC in the UK could lead to the creation of 3.3 million new jobs by 2030 and a £16 billion increase in GDP [4,7,13].
- India: CC has the potential to generate over 2 million jobs in India and contribute \$55 billion to the country's GDP by 2025, according to a report by Google and KPMG [8,12–14].
- Germany: The adoption of CC in Germany has the potential to create 1.7 million new jobs and generate €63 billion in annual revenue by 2025, according to a study by Azadi et al. [3].
- Japan: The CC market in Japan is expected to reach \$14.2 billion by 2022, driving economic growth and creating new job opportunities [6,13,15].

- Australia: CC has the potential to generate \$9.4 billion in annual revenue and create over 31,000 new jobs in Australia by 2025, according to a report by the Centre for International Economics [15,16].
- Brazil: The adoption of CC in Brazil is expected to contribute \$27 billion to the country's GDP by 2025 and create over 240,000 new jobs, according to a study by ABES [16,17].
- Canada: A report by the Information and Communications Technology Council found that CC could create over 50,000 new jobs in Canada by 2020 and contribute \$15 billion to the country's GDP [15,16,18].
- Singapore: CC is expected to contribute \$30 billion to Singapore's GDP and create over 22,000 new jobs by 2025, according to a study by Microsoft and IDC [14,16,19].

2.2. Past literature on opportunities of economic impact of cloud computing

Cloud Computing has become a ubiquitous technology that has been increasingly adopted by individuals and organizations worldwide [12–16]. It has brought about significant changes in the way businesses operate, interact, and compete. CC provides various benefits, including scalability, cost-effectiveness, flexibility, and accessibility, making it an attractive option for businesses of all sizes [2,8,13,18,19]. The EI of CC has been the subject of many studies in recent years, and this literature review provides a summary of the findings of these studies.

Oke et al. [1] identified CC as one of the ten tech-enabled business trends that will have a significant impact on the economy in the coming years. The authors suggest that CC will enable companies to reduce costs, increase efficiency, and accelerate innovation. They argue that CC will create new opportunities for businesses, particularly those in emerging markets. Gammelgaard and Nowicka [2] examined the EI of CC on e-commerce. They found that CC can reduce the costs of e-commerce operations significantly. The authors argue that CC will enable e-commerce companies to provide better services to customers, improve efficiency, and increase revenue. Azadi et al. [3] provided a comprehensive definition of CC and identified its key characteristics, including on-demand self-service, broad network access, resource pooling, rapid elasticity, and measured service. The authors suggest that these characteristics make CC an attractive option for businesses seeking to reduce costs, increase efficiency, and improve agility.

According to Yenugula et al. [4], the public cloud market is expected to grow by 17.5% in 2019, reaching a total of \$214.3 billion. The authors suggest that this growth is driven by the increasing adoption of CC by businesses worldwide. They argue that CC will enable businesses to innovate, reduce costs, and improve agility, making it a critical driver of economic growth. Al-Sharafi et al. [5] discussed a study that estimated the EI of AWS on the global economy. The study found that AWS has created over \$1.6 trillion in economic value for businesses worldwide, including \$214 billion in 2019 alone. The authors suggest that AWS has enabled businesses to reduce costs, improve efficiency, and accelerate innovation, making it a critical driver of

economic growth [5,11,14]. CC has emerged as a critical driver of economic growth, enabling businesses to reduce costs, increase efficiency, and accelerate innovation.

The literature review demonstrates that CC has a significant impact on various sectors, including e-commerce, emerging markets, and public cloud services [17,19]. The EI of CC is expected to grow in the coming years, making it an essential technology for businesses seeking to remain competitive in the digital age.

2.3. Past literature on challenges of economic impact of cloud computing

Cloud Computing has been widely adopted by individuals and organizations worldwide due to its many benefits, including scalability, cost-effectiveness, flexibility, and accessibility [12,16,18–20]. However, the adoption of CC has also presented various challenges that affect its EI. This literature review provides a summary of the findings of studies that have examined the economic challenges of CC.

Oke et al. [20] identified several challenges associated with the adoption of CC, including security and privacy concerns, data ownership and control, interoperability, reliability, and regulatory compliance. The authors suggest that these challenges may limit the adoption of CC and affect its EI. Arpaci et al. [6] examined the performance of CC services for scientific computing. The authors found that the performance of CC services varies depending on the workload and service provider. They suggest that this variability may affect the EI of CC, as businesses may not be able to predict the performance and cost of CC services accurately. Saidi and Bardou [7] identified several challenges associated with CC, including data security and privacy, vendor lock-in, service level agreements (SLAs), and compliance issues. The authors suggest that these challenges may limit the adoption of CC and affect its EI, particularly for businesses that rely on sensitive or proprietary data. Mondal and Goswami [21] identified several security challenges associated with CC, including data confidentiality, integrity, availability, and compliance. The authors suggest that these challenges may limit the adoption of CC and affect its EI, particularly for businesses that rely on sensitive or confidential data. Sahoo et al. [8] identified several challenges associated with the Internet of Things (IoT), which is closely related to CC. The authors suggest that these challenges, including interoperability, standardization, security, privacy, and regulatory issues, may limit the adoption of IoT and affect its EI.

Xia et al. [9] examined the energy-saving potential of CC for mobile users. The authors found that offloading computation to the cloud can reduce the energy consumption of mobile devices, but there are challenges associated with data transmission and security. They suggest that these challenges may affect the EI of CC for mobile users. Banimfreg [10] conducted a systematic review of studies that examined the energy efficiency of CC. The authors found that energy consumption is a significant concern for CC, and there are challenges associated with energy-efficient resource allocation and workload management. They suggest that these challenges may affect the EI of CC, particularly for cloud service providers who incur significant energy costs. Oke et al. [22] conducted a systematic literature review of studies that examined the use of blockchain technology in CC. The authors found that there are

several challenges associated with the integration of blockchain technology and CC, including scalability, interoperability, security, and privacy. They suggest that these challenges may limit the adoption of blockchain technology in CC and affect its EI. Katal et al. [11] examined the EI of CC in the agriculture sector. The authors found that CC can improve the efficiency and productivity of agricultural operations, but there are challenges associated with data security, data privacy, and rural broadband connectivity. They suggest that these challenges may affect the EI of CC in agriculture, particularly in developing countries.

The literature review demonstrates that the EI of CC is affected by several challenges, including security and privacy concerns, data ownership and control, interoperability, reliability, regulatory compliance, vendor lock-in, SLAs, performance variability, energy consumption, blockchain integration, and rural broadband connectivity [1,2,5,8,15–19,22]. Addressing these challenges is essential for maximizing the economic benefits of CC in various industries and domains.

2.4. Novelty and research gaps on economic impact of cloud computing

The novelty of assessing the EI of CC lies in its potential to transform traditional business models and create new opportunities for organizations across various industries. While there is a significant body of literature on the technical and operational aspects of CC, relatively little research has been conducted on its EI, particularly in terms of opportunities and challenges. The research gap in assessing the EI of CC is primarily related to the lack of empirical evidence and standardized metrics to measure its EI. While there are several studies that examine the EI of CC in specific industries or domains, there is a need for more comprehensive and comparative studies that examine the broader EI of CC across various sectors. Furthermore, there is a need to develop frameworks and methodologies to assess the EI of CC that take into account the unique characteristics of CC, such as its on-demand, pay-per-use, and resource pooling models. Such frameworks could help organizations make informed decisions about adopting CC and help policymakers design effective policies to promote its adoption and maximize its EI. Overall, there is a significant research gap in assessing the EI of CC, particularly in terms of opportunities and challenges, and there is a need for more empirical evidence, standardized metrics, and frameworks to guide research in this area.

This study employs a narrative literature review methodology to assess the EI of CC. While this approach allows for a broad thematic synthesis and exploration of key trends, challenges, and opportunities, it also presents certain limitations.

- **Subjectivity in source selection:** The inclusion of studies in a narrative review is often guided by the authors' judgment, which can introduce potential biases. Unlike systematic reviews, this approach lacks predefined inclusion criteria or a structured search strategy, which may result in the omission of relevant studies or an overemphasis on certain perspectives.
- **Lack of quantitative validation:** Narrative reviews primarily rely on qualitative synthesis and do not utilize statistical methods to aggregate data. Consequently, the findings in this study should be interpreted as thematic insights rather than quantitatively validated conclusions.

- Temporal relevance of sources: The rapidly evolving nature of Cloud Computing implies that some included studies might become outdated, limiting the relevance of findings to current developments.
- Generalization issues: As the narrative review aggregates studies across diverse sectors and geographies, the findings might not account for specific regional or sectoral nuances, leading to potential overgeneralization.

By acknowledging these limitations, this study seeks to provide transparency about the methodology's constraints. Future research should consider complementing this narrative review with systematic or meta-analytical approaches to provide a more rigorous and comprehensive understanding of the Economic Impact (EI) of Cloud Computing.

3. Cloud computing impact on economic growth of different countries

Cloud Computing has had a significant impact on the economic growth of different countries around the world [21,22]. Cloud Computing continues to evolve as a critical driver of economic transformation. Recent studies highlight its potential to revolutionize business operations and global productivity. For instance, a 2023 McKinsey report estimates that cloud technology could generate up to USD 3 trillion in value by 2030 through cost optimization, productivity gains, and the development of innovative business models [23]. This emphasizes the pressing need for a comprehensive understanding of its EI. McKinsey's latest study underscores the vast economic opportunities that Cloud Computing presents. It predicts that cloud adoption could contribute USD 3 trillion in value by 2030, driven by three primary factors: cost reduction and optimization, productivity enhancements, and the creation of new business models [23,24]. This aligns with findings from other literature that highlight the transformative potential of cloud technologies in enabling businesses to scale, innovate, and achieve operational efficiencies. Here are some of the ways in which CC impacts the economic growth of countries.

Cost savings: CC enables organizations to reduce the hardware and software investments. This can result in significant cost savings for businesses, allowing them to invest in other areas of their business and drive economic growth [20,21]. CC can provide significant cost savings for businesses in several ways, which can have a positive EI. There are some ways CC can help with cost savings. Many cloud service providers may result in significant cost savings, as businesses do not have to pay for unused resources or maintain costly infrastructure. CC can help businesses save money by avoiding the costs associated with overprovisioning or underutilization of resources [18,19,21]. With CC, businesses do not have to worry about maintaining and upgrading their IT infrastructure, as the cloud service provider takes care of these tasks. This can help businesses save money on maintenance costs and ensure their IT infrastructure is always up-to-date. CC can enable businesses to support a remote workforce, which can help save on office space, commuting expenses, and other associated costs. This can also help businesses attract and retain talented employees who may prefer to work remotely [13,19]. The cost savings provided by CC can have

a positive EI on businesses by enabling them to operate more efficiently, reduce costs, and focus on their core business activities as shown in **Figure 2**.

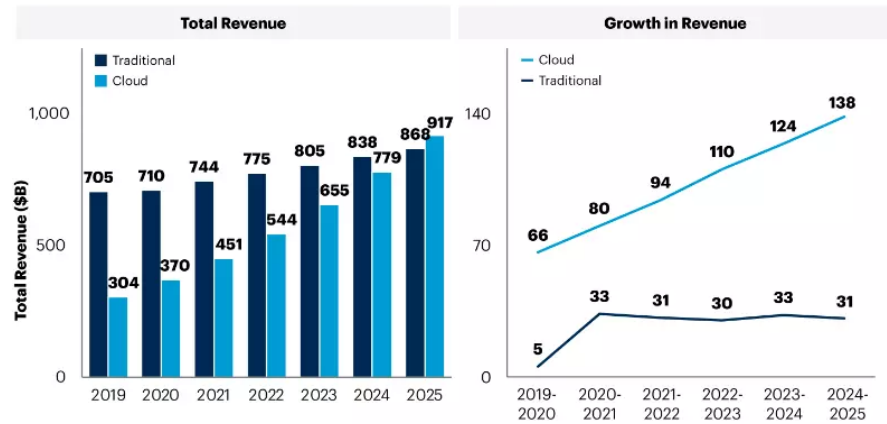


Figure 2. Total vs. growth in revenue in cloud computing.

Source: Gartner.

Increased productivity: Cloud Computing enables organizations to access computing resources, data storage, and applications on demand, enabling them to be more agile and responsive to market changes [9]. This increased productivity can result in higher revenue and job creation. CC can increase productivity for businesses in several ways, which can have a positive EI. There are some ways CC can help increase productivity. CC allows team members to increase productivity by reducing the time and effort required for coordination, communication, and file sharing. With CC, employees can access the applications, data, and resources [10,11]. This can help increase productivity by enabling employees to work remotely, on the go, or during off-hours, as well as reducing the time and effort required for commuting and office-related tasks. CC allows businesses to automate routine and repetitive tasks, such as backups, updates, and maintenance, using tools and services provided by the cloud service provider [19,21]. This can help increase productivity by reducing the time and effort required for manual tasks, as well as minimizing the risk of errors and downtime. CC provides faster on-demand access to IT resources, enabling rapid prototyping and testing and facilitating collaboration and feedback from customers and stakeholders. CC can help businesses to respond quickly by providing the flexibility and scalability needed to adapt and scale their IT resources as needed [22]. The productivity gains provided by CC can have a positive EI on businesses by enabling them to operate more efficiently, reduce costs, and accelerate innovation and growth.

Innovation: CC enables organizations to innovate more rapidly by providing access to advanced technologies by driving economic growth. Innovation can have a significant impact by enabling new and advanced capabilities that can help businesses become more efficient, agile, and competitive [17,22]. Here are some examples of how innovation can change the EI of CC. CC allows businesses to gain insights and inform business decisions. Innovations in machine learning and artificial intelligence (AI) can further enhance the capabilities of data analytics, enabling businesses to uncover new patterns and trends, identify opportunities for optimization and cost savings, and improve customer experience and satisfaction [2,3,7,15]. Edge

computing is an innovative approach to CC that involves processing and storing data closer to the source, such as on devices or sensors, rather than sending it to a central cloud data center. This can help businesses reduce latency, improve performance, and increase efficiency, especially for applications that require real-time data processing and analysis. Serverless computing is an innovative approach to CC that involves running applications without the need for server infrastructure [9]. This can help businesses reduce costs, simplify application development and deployment, and increase agility, as they can focus on building and deploying applications without having to worry about managing and scaling infrastructure [11]. Hybrid cloud is an innovative approach to CC that involves clouds to meet business needs. This can help businesses balance the security that can control on-premises infrastructure. Innovation can change the EI of CC by enabling new and advanced capabilities that can help businesses become more efficient, agile, and competitive [12]. By leveraging innovative CC technologies and services, businesses can reduce costs, increase productivity, and accelerate innovation and growth.

Job creation: CC has created new job opportunities in areas such as cloud architecture, cloud security, and cloud administration. This can help to boost economic growth and reduce unemployment [1]. CC can create new job opportunities and increase demand for existing roles, leading to a positive EI. Here are some ways CC can create jobs. Cloud service providers require a range of technical and non-technical roles, including software engineers, network engineers, sales and marketing professionals, and customer support specialists [4]. Many businesses are looking to migrate their IT infrastructure to the cloud or integrate their existing on-premises infrastructure with cloud-based services. This has created a demand for cloud migration and integration specialists, who can help businesses plan, execute, and manage their cloud migration projects. Cloud security is a critical concern for businesses that use CC services [6,13]. This has led to the creation of new job roles, such as cloud security architects, who can design and implement secure cloud environments, and cloud security analysts, who can monitor and manage cloud security risks. CC has enabled more efficient business applications than traditional on-premises infrastructure. This has created a demand for cloud application developers, who can design, build, and maintain cloud-based applications and services [10]. CC has had a significant impact on job creation in different countries, as it has led to the development of new industries and services. Here are some examples of job creation through CC EI in different countries as shown in **Table 1**. The adoption of CC can create new job opportunities and increase demand for existing roles, leading to a positive EI as shown in **Figure 3**. By investing in CC skills and expertise, businesses can leverage the benefits of CC while also contributing to job creation and economic growth.

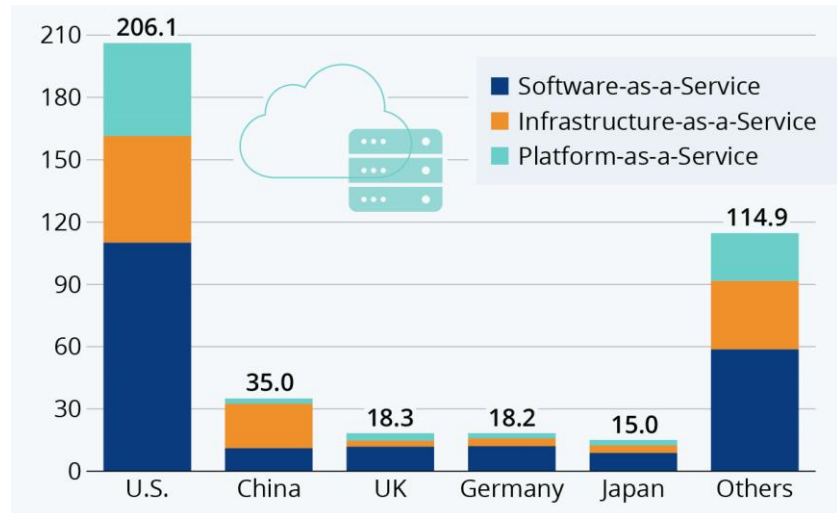


Figure 3. Estimated revenue of public cloud computing service in different countries.

Source: Statista.

Table 1. Job creation information related cloud computing in different countries.

Sl.No.	Country name	Job creation information
1	United States	The United States is home to many of the largest CC companies in the world, including Amazon Web Services, Microsoft Azure, and Google Cloud. These companies have created thousands of jobs in the United States, both in their own operations and in the businesses that use their cloud services [14,21]. According to a report by IDC, the CC industry is expected to create more than 7 million jobs by 2025 [11,12].
2	India	India is a major player in the global IT outsourcing industry, and many Indian businesses are using CC to develop and deploy software more efficiently. This has led to the creation of new jobs in software development, IT management, and cloud infrastructure management [17,21,22]. According to a report by NASSCOM, the CC industry in India is expected to create more than 1 million jobs by 2025 [13,14].
3	Australia	Australia has a highly developed CC market, and many businesses are using cloud services to improve their operations and reduce costs. This has led to the creation of new jobs in IT management, data analytics, and cloud infrastructure management [6,10]. According to a report by Deloitte, the adoption of CC in Australia is expected to create more than 30,000 new jobs by 2025 [15,16].
4	China	China has a rapidly growing CC market, and many Chinese businesses are using cloud services to improve their operations and expand their reach. This has led to the creation of new jobs in software development, data analytics, and cloud infrastructure management [13,19,22]. According to a report by CCID Consulting, the CC industry in China is expected to create more than 1.5 million jobs by 2025 [17,18].
5	United Kingdom	The United Kingdom has a highly developed CC market, and many businesses are using cloud services to improve their operations. This has led to the creation of new jobs in IT management, data analytics, and cloud infrastructure management [3,12,20]. According to a report by Oxford Economics, United Kingdom is expected to create more than 700,000 new jobs by 2025 [19,21].

Source: Author’s own elaboration.

Global competitiveness: CC enables businesses to compete more effectively on the global stage by providing access to advanced technologies and enabling greater collaboration and innovation [13]. This can lead to the growth of new business opportunities and increased economic growth. Global competitiveness can have a significant impact on the economic benefits of CC by influencing the adoption and use of CC services across different industries and countries. Here are some ways global competitiveness can change the EI of CC [21]. Countries that are more competitive in terms of innovation and technology adoption are more likely to adopt CC services at a faster rate. This can lead to increased productivity, cost savings, and innovation, which can have a positive EI. CC enables collaboration and information sharing across

different teams and departments, as well as across different countries and regions [22]. This can help businesses become more competitive by enabling them to leverage the expertise and resources of their global workforce. CC enables businesses to access global markets more easily by providing on-demand access to IT resources, enabling faster time-to-market, and reducing the need for physical infrastructure [16,17]. This can help businesses become more competitive by enabling them to expand their reach and compete with businesses in other countries. CC can help businesses become more competitive by providing enhanced security and compliance capabilities. Countries that are more competitive in terms of data privacy and cybersecurity are more likely to adopt and develop CC services that meet the highest standards of security and compliance [10–14]. Here are some examples of how global competitiveness has changed the EI of CC in different countries, as shown in **Table 2**. Global competitiveness can change the EI of CC by influencing the adoption and use of CC services across different industries and countries, as shown in **Figure 4**. By leveraging the benefits of CC, businesses and countries can become more competitive, innovative, and productive, leading to economic growth and job creation [9,14,20–22]. Overall, CC has a significant impact on the economic growth of countries by driving cost savings, increasing productivity, enabling innovation, creating new jobs, and boosting global competitiveness.

Table 2. Global competitiveness information related to cloud computing in different countries.

Sl.No.	Country name	Global competitiveness information
1	United States	The United States is one of the most competitive countries in terms of innovation and technology adoption. This has led to a high adoption rate of CC services, with many businesses using CC to improve productivity, reduce costs, and drive innovation [3,4]. The United States is also home to some of the largest cloud service providers, which helped to drive the growth of the CC industry and create new job opportunities.
2	China	China is a highly competitive country in terms of entrepreneurship and innovation, and has a rapidly growing CC market. The Chinese government has encouraged the adoption of CC by providing incentives to businesses that use cloud services, and by investing in the development of cloud infrastructure [12,14,18]. As a result, many Chinese businesses are using CC to improve their operations, expand their reach, and compete with businesses in other countries.
3	Singapore	Singapore is one of the most competitive countries in terms of data privacy and cyber security, and has a highly developed CC market. Many businesses in Singapore are using CC to improve their operations, reduce costs, and drive innovation [9].
4	Germany	Germany is a highly competitive country in terms of manufacturing and engineering, and has a strong focus on data privacy and security. Many German businesses are using CC to improve their operations, streamline processes, and reduce costs. However, the adoption of CC in Germany has been slower than in other countries due to concerns about data privacy and security [2,13,21]. As a result, many German businesses are choosing to use cloud services provided by German companies, rather than international cloud service providers.
5	India	India is a highly competitive country in terms of software development and outsourcing. Many Indian businesses are using CC to develop and deploy software more quickly and efficiently than traditional on-premises infrastructure [8,12–16,20]. The Indian government has also launched initiatives to encourage the adoption of CC by SMEs, and has invested in the development of cloud infrastructure to support the growth of the Indian CC market.

Source: Author’s own elaboration.

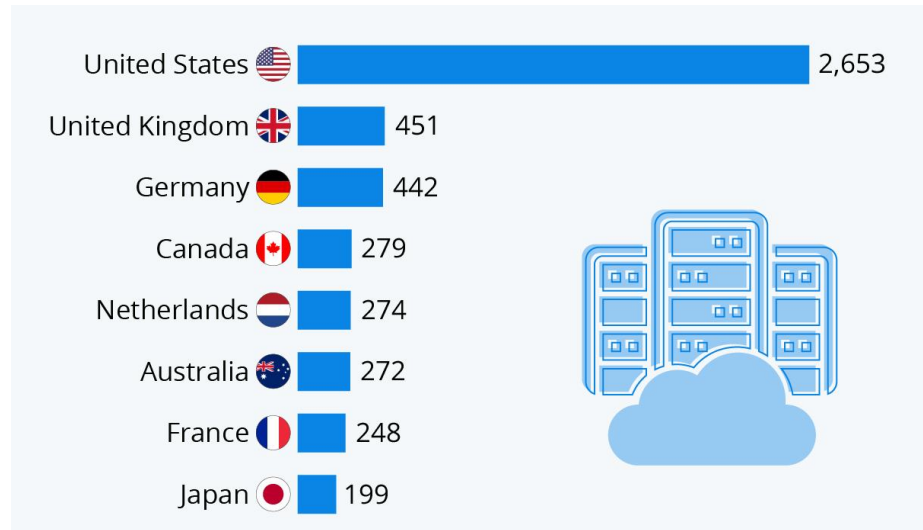


Figure 4. Number of data center per country.

Source: Statista.

4. Classification of cloud computing business

Cloud Computing has revolutionized the way businesses operate, and it has given rise to a new generation of cloud-based businesses that offer a range of services to organizations of all sizes. Here are some common classifications of businesses based on their use of CC [19,20]. These are businesses that were born in the cloud, and their entire operations are based on CC. Cloud-native businesses typically leverage the latest cloud technologies to develop and deliver their products and services, and they operate with a lean, agile, and flexible business model. These are businesses that have migrated some or all of their operations to the cloud. Cloud-enabled businesses typically use cloud services such as IaaS, PaaS, and SaaS to streamline their operations, reduce costs, and improve efficiency [1,5,19]. These are businesses that offer cloud-based services to other businesses.

Cloud service providers may offer a range of services, including cloud storage, cloud security, cloud consulting and integration, and more. These are businesses that specialize in helping other businesses navigate the complexities of CC [1–3,11]. Cloud consulting firms may offer services such as cloud migration planning, cloud infrastructure optimization, and cloud security assessment. These are businesses that help other businesses integrate their cloud-based services with other systems and applications. Cloud-integration firms may offer services such as cloud-to-cloud integration, cloud-to-on-premise integration, and more [12,13]. These are businesses that specialize in providing cloud-based security solutions to other businesses. Cloud security firms may offer services such as cloud data encryption, cloud access control, and cloud threat detection. These are just a few examples of how businesses can be classified based on their use of CC. As CC continues to evolve and mature, we can expect to see many new types of cloud-based businesses emerge.

These findings align with the projections from McKinsey’s 2023 analysis, which positions Cloud Computing as a key enabler of global economic growth. By 2030, the cloud is expected to deliver up to USD 3 trillion in value, illustrating its pivotal role in driving productivity, reducing costs, and fostering innovation through new business

models [23,24]. This reinforces the imperative for policymakers, researchers, and organizations to invest in and strategically adopt cloud solutions to fully capture its potential.

5. Negative economic impact of cloud computing

While CC has many advantages and has transformed the way businesses operate, there are also some negative EIs that need to be considered. Here are some potential negative EIs of CC. Migrating to the cloud can be a complex and expensive process [3,6–8,10]. Businesses need to invest in new hardware and software, train employees on new technologies, and hire cloud consultants to assist with the migration process. These costs can add up quickly and may exceed the cost savings that CC promises. When businesses move their operations to the cloud, they become dependent on the service providers that provide the cloud services [11,12]. This dependence can create a lock-in effect, where businesses find it difficult to switch to a different provider due to the high switching costs involved. This lack of competition can lead to higher prices and reduced innovation. CC introduces new security risks that businesses need to address.

Data stored in the cloud may be vulnerable to hacking, data breaches, and other cyberattacks. These risks can be mitigated through proper security measures, but implementing these measures can be expensive and time-consuming [14,15,17]. When businesses use cloud services, they often have limited control over the infrastructure and software that support their operations. This lack of control can make it difficult for businesses to customize their systems and applications to meet their specific needs [20]. CC raises concerns about data privacy, particularly when data is stored on servers located in different countries with different data protection laws. Businesses need to ensure that they comply with these laws, which can be complex and costly. Overall, while CC has many advantages, businesses need to carefully consider the potential negative EIs before migrating their operations to the cloud [19,22]. By understanding these risks and developing strategies to mitigate them, businesses can successfully leverage the benefits of CC while minimizing the negative EIs.

6. Challenges associate with economic impact and cloud computing

Assessing the EI of CC can be challenging due to several factors, including the following aspects. One of the biggest challenges associated with assessing the EI of CC is to provide security to the businesses, which can be complex and costly [16]. CC often involves integrating multiple services and platforms from different providers. This can create interoperability issues, where different systems and applications may not work seamlessly together, causing delays and inefficiencies. There is no universally accepted standard for assessing its EI compared to CC [17,18]. This can make it difficult for businesses to compare the benefits and solutions. CC is a complex technology that involves multiple layers of hardware, software, and services. This complexity can make it difficult to accurately assess the EI of CC, as there may be hidden costs and benefits that are not immediately apparent. There may be limited data available on the EI of CC, particularly for smaller businesses or emerging markets [13,20–22]. To address these challenges, businesses should carefully evaluate the costs

and benefits of CC and work with trusted service providers to ensure that they comply with data privacy and security regulations. It is also important to invest in training and resources to manage the complexity of CC and work towards standardization and interoperability between different cloud services and platforms.

This study employs a narrative literature review methodology, which, while effective for synthesizing broad themes and trends, presents several limitations. Firstly, the selection of sources is subject to the authors' judgment, which could introduce biases and result in the exclusion of relevant studies. Unlike systematic reviews, this approach does not rely on predefined inclusion and exclusion criteria or a structured search protocol, which might limit the reproducibility of the findings. Secondly, the lack of quantitative analysis limits the study's ability to provide statistically validated conclusions, restricting the generalizability of its insights. Thirdly, the rapidly evolving nature of Cloud Computing poses a challenge in maintaining the temporal relevance of the included literature, as new developments could render some findings obsolete. Furthermore, the focus on secondary data limits the study's ability to incorporate real-time industry-specific case studies or empirical data, which could provide deeper insights into sector-specific impacts of cloud adoption. To address these limitations, future research should adopt a mixed-methods approach, combining qualitative and quantitative analyses, and consider conducting systematic reviews with standardized inclusion criteria. Empirical studies utilizing primary data from surveys, interviews, or case studies across various industries and regions would further enhance the depth and applicability of the findings. Additionally, longitudinal studies tracking the Economic Impact of cloud adoption over time could provide a dynamic perspective, helping policymakers and organizations make more informed decisions about leveraging cloud technologies. By addressing these limitations, future research can build on the current study's findings to present a more comprehensive and robust understanding of the Economic Impact of Cloud Computing.

7. Conclusion

Cloud Computing has had a significant EI on businesses around the world. It has provided opportunities for cost savings, scalability, innovation, and global reach. However, it has also presented challenges in terms of data privacy and security concerns, interoperability issues, lack of standardization, complexity, and limited data availability. Assessing the EI of CC is a complex task that requires careful evaluation of the costs and benefits associated with cloud services and solutions. It also requires businesses to work with trusted service providers and comply with data privacy and security regulations. As CC continues to evolve, businesses must stay informed about the latest trends and best practices to effectively leverage its EI. This may involve investing in training and resources to manage the complexity of CC, working towards standardization and interoperability between different cloud services and platforms, and adopting new technologies and business models that leverage the benefits of CC. Overall, the EI of CC is significant and presents both opportunities and challenges for businesses. By carefully managing the risks and taking advantage of the opportunities, businesses can successfully leverage CC to drive growth and innovation.

This study highlights the transformative EI of CC, underscoring its potential to drive cost efficiencies, enhance productivity, and foster innovation across various sectors. Key findings reveal that CC enables businesses to optimize operational costs by reducing infrastructure investments and leveraging scalable, on-demand services. Additionally, CC significantly increases productivity by enhancing collaboration, streamlining operations, and supporting remote work environments. Perhaps most notably, CC serves as a catalyst for innovation, enabling the development of new business models and access to advanced technologies like AI and ML. However, challenges persist, including data security and privacy concerns, interoperability issues, and regulatory barriers, which stakeholders must address to maximize its benefits.

For businesses, adopting CC provides an opportunity to achieve a competitive advantage by reducing costs, improving efficiency, and accelerating innovation. Organizations must also invest in robust security measures and employee training to navigate associated challenges effectively. Policymakers, on the other hand, play a critical role in creating regulatory frameworks that promote cloud adoption while safeguarding data security and privacy. Additionally, they must focus on bridging the digital divide to ensure equitable access to cloud technologies. For researchers, the findings open avenues for future exploration, particularly in developing standardized metrics for assessing the EI of CC, investigating sector-specific impacts, and conducting longitudinal studies to track its evolution over time.

In conclusion, CC holds immense potential to shape the future of global economies. By addressing current challenges and capitalizing on opportunities, stakeholders can harness the full spectrum of benefits that CC offers, driving sustainable growth, innovation, and digital transformation on a global scale.

7.1. Practical implications

The research paper on assessing the EI of CC provides practical implications for businesses looking to adopt CC solutions. Some of these practical implications include the following points. Businesses must conduct a thorough cost-benefit analysis to determine the potential savings and benefits of adopting CC solutions. This analysis should take into account the costs of transitioning to the cloud, such as migration costs, subscription fees, and training costs, as well as the potential benefits, such as increased productivity, scalability, and innovation. Businesses must take security and privacy measures seriously when adopting CC solutions. This involves understanding data protection regulations and working with trusted service providers to ensure that data is stored and transmitted securely. Interoperability is critical for businesses to effectively integrate multiple cloud services and platforms.

To ensure interoperability, businesses must work with cloud service providers that offer open standards and application programming interfaces (APIs) that enable seamless integration. Standardization is key to ensuring that businesses can accurately compare the costs and benefits of different cloud services and solutions. To promote standardization, businesses can work with industry associations and standards bodies to develop common frameworks and metrics for assessing the EI of CC. Businesses must invest in training and resources to manage the complexity of CC solutions. This

involves recruiting and training talent with the skills and expertise needed to manage and optimize CC solutions, such as cloud architects, developers, and data analysts. The practical implications of assessing the EI of CC provide businesses with a roadmap for successfully adopting and leveraging CC solutions to drive growth and innovation. By carefully evaluating the costs and benefits, implementing security and privacy measures, ensuring interoperability and standardization, and investing in talent management, businesses can effectively leverage CC to achieve their strategic goals.

7.2. Limitation

There are several limitations associated with assessing the EI of CC. These limitations can impact the accuracy and reliability of EI assessments and include the following. Data availability can be a major limitation when assessing the EI of CC. This is due to the lack of standardized metrics for measuring the impact of CC, as well as the lack of data transparency from cloud service providers. This can make it difficult to accurately measure the EI of CC. CC solutions can be complex, and businesses may struggle to accurately assess the impact of these solutions on their operations. This can be due to the complexity of CC technologies, the complexity of integration with existing systems, and the difficulty of quantifying the benefits of CC. Interoperability issues can limit the ability of businesses to integrate multiple cloud services and platforms. This can impact the accuracy of EI assessments, as businesses may not be able to accurately measure the impact of CC on their operations. It can limit the adoption of CC solutions, which can impact the EI of CC. This is due to the potential risks associated with storing sensitive data in the cloud, such as data breaches, cyberattacks, and compliance issues. These limitations highlight the need for businesses to carefully evaluate the costs and benefits of CC solutions, work with trusted service providers, and comply with data privacy and security regulations to ensure accurate assessments of the EI of CC.

7.3. Future scope

The future scope of assessing the EI of CC presents several opportunities and challenges. Some of these opportunities include the following. Increased standardization will make it easier for businesses to accurately compare the benefits and solutions. This will involve the development of common frameworks and metrics for measuring the EI of CC. Enhanced security and privacy measures will enable businesses to more effectively protect sensitive data in the cloud. This includes the use of two-factor authentication to minimize the risk of data breaches and cyberattacks. Hybrid cloud solutions will enable businesses to more effectively balance the benefits of CC with the need for data security and privacy. This will involve the integration of private and public cloud solutions to create a more flexible and scalable infrastructure. These opportunities also present several challenges, including the need for businesses to continually update their cloud infrastructure to keep pace with technological advancements and the need for businesses to effectively manage talent and resources to ensure the effective implementation and management of CC solutions. Overall, the future scope of assessing the EI of CC presents a range of opportunities and challenges,

and businesses must stay up-to-date with the latest trends and technologies to effectively leverage the benefits of CC.

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