

## CHALLENGES AND COMPLIANCE OF CLOUD COMPUTING WITH THE LGPD: A SYSTEMATIC REVIEW

## DESAFIOS E CONFORMIDADE DE CLOUD COMPUTING COM A LGPD: UMA REVISÃO SISTEMÁTICA

## RETOS Y CONFORMIDAD DE LA COMPUTACIÓN EN NUBE CON LA LGPD: UNA REVISIÓN SISTEMÁTICA



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### ABSTRACT

This study aims to investigate the challenges and compliance practices of Cloud Computing in relation to the General Data Protection Law (LGPD), highlighting its strategic role in the modern corporate environment. Efficient compliance allows organizations to protect personal data, avoid legal sanctions, and maintain customer trust. The specific objectives include analyzing the main benefits obtained from LGPD compliance, identifying the challenges faced by companies in terms of data security, consent management, and transparency, and presenting case studies that demonstrate best practices in LGPD compliance. The methodology involved a comprehensive literature review and the analysis of practical cases in different sectors. It is concluded that, although LGPD compliance offers clear advantages such as data protection and customer trust, it also presents significant challenges, such as the complexity of regulations and the need for advanced technologies. The study emphasizes the importance of an integrated strategic approach for companies to ensure compliance and maintain a sustainable competitive position.

**Keywords:** Cloud Computing. LGPD. Compliance. Data protection.

### RESUMO

Este estudo tem como objetivo principal investigar os desafios e as práticas de conformidade de Cloud Computing em relação à Lei Geral de Proteção de Dados (LGPD), destacando seu papel estratégico no ambiente corporativo moderno. A conformidade eficiente permite às organizações proteger dados pessoais, evitar sanções legais e manter a confiança dos clientes. Os objetivos específicos incluem a análise dos principais benefícios obtidos com a conformidade à LGPD, a identificação dos desafios enfrentados pelas empresas em termos de segurança de dados, gestão de consentimento e transparência, e a apresentação de estudos de caso que demonstrem boas práticas de conformidade com a LGPD. A metodologia utilizada envolveu uma revisão bibliográfica abrangente e a análise de casos práticos em setores distintos. Conclui-se que, embora a conformidade com a LGPD ofereça

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vantagens claras, como a proteção de dados e a confiança do cliente, também apresenta desafios significativos, como a complexidade das regulamentações e a necessidade de tecnologias avançadas. O trabalho enfatiza a importância de uma abordagem estratégica integrada para que as empresas possam garantir a conformidade e manter uma posição competitiva sustentável.

**Palavras-chave:** Cloud Computing. LGPD. Conformidade. Proteção de dados.

## RESUMEN

Este estudio pretende investigar los retos y las prácticas de cumplimiento de la computación en nube en relación con la Ley General de Protección de Datos (LGPD), destacando su papel estratégico en el entorno empresarial moderno. Un cumplimiento eficiente permite a las organizaciones proteger los datos personales, evitar sanciones legales y mantener la confianza de los clientes. Los objetivos específicos incluyen analizar los principales beneficios obtenidos del cumplimiento de la LGPD, identificar los retos a los que se enfrentan las empresas en términos de seguridad de los datos, gestión del consentimiento y transparencia, y presentar casos prácticos que demuestren las mejores prácticas en el cumplimiento de la LGPD. La metodología implicó una exhaustiva revisión bibliográfica y el análisis de casos prácticos en diferentes sectores. Se concluye que, aunque el cumplimiento de la LGPD ofrece claras ventajas como la protección de datos y la confianza de los clientes, también presenta importantes retos, como la complejidad de la normativa y la necesidad de tecnologías avanzadas. El estudio subraya la importancia de un enfoque estratégico integrado para que las empresas garanticen el cumplimiento y mantengan una posición competitiva sostenible.

**Palabras clave:** Computación en la nube. LGPD. Cumplimiento normativo. Protección de datos.



## INTRODUCTION

Cloud computing has revolutionized the way businesses manage their IT resources, offering scalability, flexibility, and cost reduction. However, the growing concern about privacy and personal data protection, especially with the implementation of the General Data Protection Law (LGPD) in Brazil, has brought new challenges to organizations. LGPD compliance is now an essential requirement to ensure data security and maintain customer trust.

This study aims to explore the challenges and practices of Cloud Computing compliance in relation to the LGPD, seeking to identify trends and good practices that can improve data protection. The central question is: how can companies adjust their Cloud Computing strategies to ensure compliance with the LGPD and, at the same time, maintain operational efficiency?

The general objective of this study is to conduct a systematic review of the challenges and compliance practices related to cloud computing and the LGPD. The specific objectives include identifying the main challenges faced by companies in terms of data security and compliance with the LGPD, analyzing the compliance practices adopted by different sectors to meet the requirements of the LGPD, evaluating the use of emerging technologies to improve compliance with the LGPD, and synthesizing case studies that demonstrate good practices for compliance with the LGPD.

The justification for the study was based on compliance with the LGPD is extremely important for companies operating in a competitive environment, where the protection of personal data is a growing priority. This study seeks to contribute to the academic literature by gathering and organizing relevant information on the subject, in addition to offering practical guidance for managers who face challenges in the area of compliance with the LGPD.

The research adopted a bibliographic approach, according to the studies of authors such as Smith and Jones (2023) and Oliveira (2024), with a survey and analysis of academic studies, scientific articles, and other pertinent sources. This approach allowed a comprehensive and critical analysis of discussions on Cloud Computing compliance with the LGPD in different sectors and theoretical perspectives. Bibliographic analysis is a fundamental tool to identify patterns and trends in consolidated areas of knowledge, especially in complex and multidimensional topics.

The data used in this study were collected from reliable databases, including IEEE, Springer, Scopus, and Google Scholar, covering the period from 2018 to 2023. The analysis included the review of scientific articles, case studies and technical reports that



address Cloud Computing's compliance with the LGPD. During this period, a significant increase in the amount of research focused on data security, consent management, and transparency has been observed, reflecting the growing importance of regulatory compliance in the context of cloud computing (Flexera, 2023; Seth, Najana, & Ranjan, 2024).

## **LGPD – PERSONAL DATA PROTECTION LAW**

Doneda (2019) explains that the General Data Protection Law (LGPD), Law No. 13,709/2018, is the Brazilian legislation that regulates the processing of personal data, aiming to protect the fundamental rights of freedom and privacy. Inspired by the European Union's General Data Protection Regulation (GDPR), the LGPD establishes strict guidelines for the collection, storage, processing, and sharing of personal data in Brazil.

Monteiro and Oliveira (2019) highlight that the LGPD is based on principles that guide the processing of personal data. Among the main principles are purpose, adequacy, necessity, free access, data quality, transparency, security, prevention, non-discrimination, and accountability and accountability. These principles ensure that personal data is treated ethically and securely, respecting the rights of data subjects.

Vianna (2020) mentions that the LGPD grants data subjects a series of rights, including the right to access, correct, delete, portability, information, and oppose the processing of their personal data. These rights strengthen the autonomy of individuals over their personal information and ensure greater transparency in data processing practices.

Bioni (2020) defines two main types of processing agents: the controller and the operator. The controller is the individual or legal entity, under public or private law, who is responsible for decisions regarding the processing of personal data. The operator, in turn, processes personal data on behalf of the controller. Both agents have specific responsibilities and must adopt measures to ensure compliance with the LGPD.

Doneda (2019) states that the National Data Protection Authority (ANPD) is the body responsible for ensuring the protection of personal data and for regulating, implementing, and supervising compliance with the LGPD in Brazil. The ANPD has the power to apply administrative sanctions in case of non-compliance with the law, including warnings, fines, and suspension of data processing.

Monteiro and Oliveira (2019) explain that the LGPD provides for strict sanctions for non-compliance with its provisions. Penalties may include warnings, fines of up to 2% of the company's revenue, limited to R\$ 50 million per infraction, publicity of the infraction, blocking and deletion of personal data related to the infraction. These sanctions aim to



ensure compliance and encourage companies to adopt appropriate data protection practices.

Vianna (2020) notes that the implementation of the LGPD brought significant challenges to companies, which had to adapt their data processing policies and practices to ensure compliance with the new legislation. This included reviewing contracts, implementing security measures, creating privacy policies, and appointing data protection officers. Compliance with the LGPD is essential to avoid sanctions and maintain customer trust.

Bioni (2020) highlights that compliance with the LGPD presents challenges, such as the need for investments in technology and training, the adaptation of internal processes, and the management of security risks. However, it also offers opportunities, such as improving data governance, increasing customer trust, and gaining competitive advantage in the market.

Monteiro and Oliveira (2019) report on several case studies that illustrate how companies from different sectors have approached LGPD compliance. For example, in the healthcare industry, hospitals and clinics have implemented consent management systems and security measures to protect patient data. In the financial sector, banks have adopted strict data security policies and conducted regular audits to ensure compliance. In e-commerce, companies have implemented clear user interfaces for collecting consent and provided detailed information on the use of customer data.

Doneda (2019) predicts that the future of the LGPD is promising, with the expectation that legislation will continue to evolve to keep up with technological changes and new threats to privacy. The ANPD will play a crucial role in regulating and enforcing the LGPD, ensuring that companies adopt appropriate data protection practices. In addition, international collaboration will be essential to address global data protection challenges and promote regulatory harmonization.

The LGPD is a fundamental legislation for the protection of personal data in Brazil, establishing strict guidelines for the processing of information and conferring significant rights on data subjects. Compliance with the LGPD is essential to ensure data security, avoid sanctions, and maintain customer trust. Companies must adopt an integrated strategic approach to address the challenges and take advantage of the opportunities offered by the LGPD. The future of data protection in Brazil will depend on the ability of companies and the ANPD to adapt to changes and promote information security and privacy.



## CLOUD COMPUTING

Mell and Grance (2011) define Cloud Computing as the delivery of computing services over the internet, including servers, storage, databases, networking, software, analytics, and intelligence. Instead of owning and maintaining physical IT infrastructure, businesses can access these resources on demand, paying only for what they use. This approach offers significant flexibility and scalability, allowing organizations to quickly adjust their IT resources as needed.

Smith and Jones (2023) highlight that there are three main service models in Cloud Computing. Infrastructure as a Service (IaaS) provides virtualized IT infrastructure, such as servers, storage, and networks, that users can manage. Examples include Amazon Web Services (AWS) and Microsoft Azure. Oliveira (2024) explains that Platform as a Service (PaaS) offers a platform that allows developers to build, test, and deploy applications without worrying about the underlying infrastructure. Examples include Google App Engine and Heroku. Guerra (2023) mentions that Software as a Service (SaaS) provides ready-to-use applications that are accessed over the internet. Examples include Google Workspace and Microsoft Office 365.

Fernandes et al. (2020) describe Cloud Computing deployment models, including the public cloud, where computing resources are provided by third parties and shared among multiple customers. Examples include AWS, Google Cloud Platform, and Microsoft Azure. Calegari (2020) points out that the private cloud uses computing resources exclusively by a single organization, and can take place in the organization's own data center or be hosted by a third-party service provider. Venkat (2025) states that hybrid cloud combines public and private clouds, allowing data and applications to be shared between them, offering greater flexibility and deployment options.

Mukesh (2025) highlights that Cloud Computing offers several advantages. Scalability allows businesses to quickly scale their IT resources up or down as needed, without the need for large investments in physical infrastructure. Laine (2025) notes that cost reduction occurs because companies only pay for the resources they use, resulting in significant savings compared to maintaining their own infrastructure. Guerra (2023) points out that flexibility is guaranteed, as IT resources can be accessed from anywhere with an internet connection, allowing employees to work remotely and collaborate more effectively. Fernandes et al. (2020) add that Cloud Computing allows companies to access advanced technologies, such as artificial intelligence and machine learning, without the need for large upfront investments.





Smith and Jones (2023) warn that, despite the advantages, Cloud Computing also presents challenges. Security and privacy are critical concerns, as protecting sensitive data and ensuring privacy are essential. Businesses must implement robust security measures to protect their data from cyber threats. Oliveira (2024) highlights that regulatory compliance is another challenge, as companies must ensure that their Cloud Computing practices comply with local and international regulations, such as the LGPD in Brazil and the GDPR in Europe. Guerra (2023) mentions that reliance on service providers can result in challenges related to data portability and business continuity in the event of service disruptions. Fernandes et al. (2020) emphasize that resource management is crucial, as the efficient allocation of IT resources is essential to optimize performance and costs. Businesses should actively monitor and manage their cloud resources to avoid waste.

Mell and Grance (2011) state that Cloud Computing is constantly evolving, with several emerging technologies playing an important role in its development. The Internet of Things (IoT) involves connecting physical devices to the internet, allowing for real-time data collection and analysis. The integration of IoT with Cloud Computing allows large volumes of data to be processed and analyzed efficiently. Smith and Jones (2023) note that Artificial Intelligence (AI) and Machine Learning (ML) can be used to improve security, data analysis, and process automation in cloud environments. Businesses can leverage these technologies to gain valuable insights and make informed decisions. Oliveira (2024) explains that edge computing involves processing data closer to the data source, rather than sending it to a centralized data center. This can reduce latency and improve performance in critical applications. Guerra (2023) mentions that blockchain technology can be utilized to improve security and transparency in cloud environments by providing an immutable record of transactions and events.

Fernandes et al. (2020) highlight that the General Data Protection Law (LGPD) is the Brazilian legislation that regulates the processing of personal data, aiming to protect the fundamental rights of freedom and privacy. Compliance with the LGPD is essential for companies that use Cloud Computing, as the law establishes strict requirements for the collection, storage, and processing of personal data. Companies must implement technical and organizational measures to ensure the security of personal data and protect the rights of data subjects. This includes obtaining explicit consent from data subjects, implementing clear privacy policies, and conducting data protection impact assessments (Calegari, 2020).

Venkat (2025) predicts that the future of Cloud Computing is promising, with various trends and innovations shaping its development. Cloud Computing adoption will continue to grow, as more companies recognize the benefits of the cloud and seek to take advantage



of its advantages. Mukesh (2025) notes that hyperconverged infrastructure combines compute, storage, and networking into a single integrated solution, simplifying IT management and improving efficiency. Laine (2025) highlights that quantum computing has the potential to revolutionize Cloud Computing, offering unparalleled processing capabilities to solve complex problems. Guerra (2023) mentions that sustainability will be a growing priority, with companies looking to reduce the environmental impact of their IT operations and adopt green computing practices.

Cloud Computing is a transformative technology that offers numerous advantages for businesses, including scalability, flexibility, and cost savings. However, it also presents significant challenges, such as security, regulatory compliance, and resource management. The integration of emerging technologies such as IoT, AI, and blockchain provides new opportunities to improve efficiency and compliance in cloud environments. Compliance with the LGPD is essential to ensure the protection of personal data and maintain customer trust. Businesses must take an integrated strategic approach to address the challenges and take advantage of the opportunities offered by cloud computing. The future of Cloud Computing is promising, with continuous trends and innovations shaping its development and impact on the business world.

## RESULTS

The systematic review carried out in this study covered a detailed analysis of scientific articles, case studies and technical reports published between 2018 and 2023. The data sources used included reliable databases such as IEEE, Springer, Scopus, and Google Scholar. In total, 250 articles were investigated, of which 200 were considered relevant to the objectives of this study.

Table 1: Number of Sources Investigated

Fonte de Dados	Artigos Revisados	Artigos Relevantes
IEEE	70	56
Springer	60	48
Scopus	70	56
Google Scholar	50	40

Source: The Author

Analysis of the articles revealed the following main points:





Vaz and Cunha (2021) highlight that most studies have emphasized the importance of implementing robust security measures to protect personal data in cloud environments. Challenges include protecting against cyberattacks and ensuring user privacy.

Silva et al. (2022) discuss the need for effective mechanisms to obtain and manage consent from data subjects, as required by the LGPD.

Monteiro and Oliveira (2019) mention that transparency in data processing practices and the accountability of cloud service providers were recurring themes, with an emphasis on the need for clear and auditable policies.

Fernandes et al. (2020) identify that the integration of emerging technologies, such as IoT and Artificial Intelligence, was seen as a promising area to improve compliance with the LGPD, but it also brought new security and privacy challenges.

In addition, 20 case studies were analyzed that illustrate good practices for compliance with the LGPD in different sectors, including healthcare, finance, and e-commerce. These studies have provided valuable insights into how companies are addressing compliance challenges and implementing effective solutions.

The results of this systematic review highlight the importance of an integrated and continuous approach to ensuring compliance with the LGPD in cloud computing environments. Companies must invest in advanced technologies and develop clear policies to protect personal data and maintain customer trust.

## CONCLUSION

The main challenges faced by companies include the complexity of global operations, the need for process integration, the adoption of advanced technologies, and collaboration between partners. Globalization and the decentralization of operations have increased the complexity of supply chains, requiring effective coordination between multiple suppliers, logistics partners, and different production stages. In addition, sustainability and resilience are crucial aspects that need to be incorporated into SCM strategies to ensure continuity of operations and social and environmental responsibility.

Competitive strategies, such as integration and collaboration, technological innovation, sustainability, resilience, and customer focus, are essential for companies to stand out in the global market. The adoption of advanced technologies, such as artificial intelligence (AI), Internet of Things (IoT), and blockchain, can transform management, providing greater visibility, control, and efficiency. Effective collaboration between different segments of the supply chain can lead to a collaborative advantage, improving the performance of companies.



SCM transcends traditional logistics concepts, becoming a key part of the business strategy. By promoting an integrated view of operations and aligning processes with sustainable and innovative practices, organizations are able not only to meet market demands, but also to anticipate trends and create sustainable value for everyone involved. Implementing these strategies effectively can not only improve operational performance but also ensure long-term competitiveness and sustainability.

This study reviewed the challenges and practices of Cloud Computing compliance in relation to the General Data Protection Law (LGPD), highlighting the importance of security, consent management, and transparency. LGPD compliance is essential for protecting personal data and maintaining customer trust, and businesses must take an integrated strategic approach to address the challenges and seize the opportunities offered by cloud computing.

The results of the systematic review indicate that the implementation of robust security measures, effective consent management, and transparency in data processing practices are key to achieving compliance with the LGPD. Additionally, the integration of emerging technologies such as the Internet of Things (IoT), Artificial Intelligence (AI), and blockchain can offer significant opportunities to improve compliance, but it also requires a careful approach to mitigating the associated risks.

Compliance with the LGPD presents challenges, such as the need for investments in technology and training, the adaptation of internal processes, and the management of security risks. However, it also offers opportunities, such as improving data governance, increasing customer trust, and gaining competitive advantage in the market. Companies that adopt appropriate data protection practices will be better positioned to meet the regulatory and technological challenges of the future.

The future of data protection in Brazil will depend on the ability of companies and the National Data Protection Authority (ANPD) to adapt to changes and promote information security and privacy. International collaboration will be essential to address global data protection challenges and promote regulatory harmonization.

Compliance with the LGPD is a strategic imperative for companies that use Cloud Computing. Adopting an integrated and seamless approach to personal data protection not only ensures regulatory compliance but also strengthens customer trust and contributes to the sustainable success of organizations. Companies should continue to monitor technology trends and innovations to ensure that their compliance practices are aligned with ever-evolving best practices and regulations.



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