A SYSTEMATIC LITERATURE REVIEW OF THE CLOUD ADOPTION FRAMEWORK

by

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Abstract

This paper provides a review of the existing literature on cloud adoption frameworks. The main objective is to identify the key components of such frameworks and understand how they can help companies adopt cloud computing effectively. The study examines and analyzes 50 publications from various sources to provide a comprehensive overview of the current state of cloud adoption frameworks. The findings suggest that a cloud adoption framework typically involves several phases, including evaluation, planning, migration, and operations, each with a set of activities and tools. The evaluation phase highlights the importance of customizing the framework to suit an organization's specific needs and the necessity of involving all stakeholders in the adoption process. Moreover, the study points to the need for more research to evaluate the effectiveness of cloud adoption frameworks and their impact on organizational performance. Overall, this research provides valuable insights for companies seeking to adopt cloud computing and for scholars looking to advance the field of cloud computing adoption.

Keywords*:* Cloud Computing, Cloud Adoption, Digital Transformation, Framework

Introduction

The Cloud Adoption Framework (CAF) is a compilation of documentation, implementation advice, best practices, and established guiding instruments (Trivedi, 2013). Before implementing cloud computing, it is essential, according to Shukur et al. (2018), to develop a solid scientific basis and perform exhaustive study and verification with the support of skilled IT experts and personnel. As a new technology, cloud computing has altered how organizations think about and use information, communication, and technology (ICT) from various perspectives. Cloud computing is a solution for a variety of problems, including increasing efficiency, reducing cost, providing more reliable and efficient services, and decreasing cycle time (Shukur et al.,2018). The emergence of cloud computing has resulted in the development of revolutionary technology that enables enterprises to develop and execute customized applications. This technology also increases the attractiveness of software as a service to businesses. As a consequence, cloud computing is today seen as an up-and-coming innovation, providing on-demand and readily scalable alternatives to company-owned IT assets provided through the internet. By embracing cloud computing, organizations may enjoy several advantages, including enhanced performance, worldwide accessibility, reduced expenses, and higher storage capacity. The US National Institute of Standards and Technology (NIST) defines cloud computing as a system that enables easy and widespread access to a collection of computing resources (such as servers, storage, applications, and services) that can be set up and taken down with minimal involvement from service providers or management personnel (Mell & Grance, 2011).

The cloud-based business services and Software-as-a-Service (SaaS) industries are expected to increase by 20.7% to $591.8B in 2023, up from $490.3B in 2022, according to Gartner's projections (DeLisi, 2023). Similarly, the IaaS (Infrastructure-as-a-Service) and PaaS (Platforms-a-Service) markets are anticipated to grow from $178.8 billion in 2022 to $331.6 billion in 2023 (DeLisi, 2023). Not only is cloud computing facilitating the operations of companies and corporations, but it is also influencing countless aspects of our personal and social lives. For instance, social media platforms have bridged the communication gap by

allowing users to communicate smoothly over the cloud. Additionally, the cloud promotes the downloading and updating of mobile apps and allows consumers to conveniently share their photographs, videos, data, and product evaluations. Thus, there is a considerable change in the corporate sector toward the use of cloud computing.

The advantages of cloud computing, including the availability of infinite resources at negligible costs, encourage businesses and research institutions to embrace the cloud for their computing and data storage needs. E-commerce, agribusiness, nuclear science, healthcare, smart grids, and scientific research also make extensive use of cloud computing (Chui et al., 2022). Using cloud technology, the pharmaceutical firm Moderna sent the first clinical batch of its COVID-19 vaccine candidate to the US National Institutes of Health for Phase I testing just 42 days after the first sequencing of the virus (Del Miglio et al., 2021). Government agencies perceive the cloud as a unified and cost-effective paradigm. The US government unveiled the Federal Government's Cloud Smart Strategy Initiative in September 2009 (Sava, 2021). The government of the United States spends more than $76 billion a year on IT services, a figure it aims to decrease by embracing cloud computing.

The fast-paced rise in cloud use has made it tough to build a comprehensive cloud adoption strategy and execute the cloud journey (Bommadevara et al., 2018). As a result, top cloud providers have developed Cloud Adoption Frameworks to simplify the process. Nevertheless, many organizations migrate to the cloud without appropriate preparation or without adhering to their current strategy. As a result, corporate executives struggle to collect and comprehend data because they lack an understanding of cloud services, which hinders cloud adoption (Opara-Martins et al., 2016). Various cloud providers have their own adoption frameworks. The primary advantage of all adoption frameworks is that they assist organizations in developing a good cloud adoption strategy and achieving success.

Problem statement

The majority of CAF share the goal of connecting adoption strategies with business results. They also provide a range of helpful tools, guidance, best practices, and documentation to expedite and streamline the cloud adoption process. Consequently, it's crucial to assess which framework offers the most comprehensive coverage of cloud adoption.

Purpose of the study

The objective of this research is to pinpoint the essential elements of every CAF, as well as to determine which frameworks have the necessary adaptability to allow companies to create a migration strategy that caters to their specific business objectives and correlates technical modifications with business demands.

Research question

RQ1: Which Cloud Adoption Framework (CAF) can best help to identify and provide a roadmap for resolving many crucial problems that organizations face during digital transformation?

Review of the literature

A CAF is necessary to help organizations plan and execute a successful transition to cloud computing. It guides best practices, tools, and processes for assessing, migrating, and managing workloads in the cloud. CAFs help organizations identify and mitigate potential risks, optimize costs, and ensure compliance with regulatory requirements. Additionally, a cloud adoption framework can help organizations to take full advantage of the benefits of cloud computing, such as increased scalability, agility, and disaster recovery capabilities.

The CAF should have an all-encompassing paradigm that supports enterprises in adopting cloud computing effectively. It includes best practices, tools, and guidelines for assessing cloud readiness, developing a strategy, and planning cloud adoption. The CAF incorporates essential areas like governance, security, compliance, and operations and is flexible to fit certain business requirements (Aronica, 2018). Various cloud providers, such as Amazon, Azure, and GCP, have their own frameworks for assisting enterprises with workload migration and management on their own cloud platforms. These frameworks offer both technical and non-technical stakeholder assistance, as well as pre-configured environments for workload deployment. These frameworks attempt to assist enterprises in aligning their cloud adoption strategy with their business goals and implementing a disciplined approach to cloud adoption (Jain & Mahajan, 2017).

The CAF facilitates the deployment of cloud technology by keeping a careful eye on critical elements such as authentication, access, and monitoring. Furthermore, by embracing the cloud, organizations may improve operations, enhance customer service, and increase profitability. Cloud technology installation may also result in more effective and simplified company operations (Pang et al., 2011). Hence, businesses should acknowledge the relevance of the cloud in their entire strategy and take measures to address particular implementation issues and associated business goals.

When a company adopts cloud computing, it brings new methods for installing, controlling, and managing technology. This transition necessitates a reevaluation of conventional practices since the capacity to construct and erase virtual data centers using code rapidly alters the game. Continuous governance is essential for cloud computing (Rebollo et al., 2014). Companies having internal IT governance rules must ensure that cloud governance supports these regulations. The degree of integration between on-premises and cloud rules is contingent on the maturity of cloud governance and the managed digital assets. As the cloud environment changes, so must governance procedures and policies.

A CAF provides a methodical approach for detecting, analyzing, and reducing cloud computing security concerns. This entails detecting possible vulnerabilities and threats, evaluating their likelihood and effect, and adopting suitable control measures. It also has compliance capabilities to assist enterprises in meeting legal requirements such as HIPAA, SOC 2, and ISO 27001, ensuring that sensitive data is safeguarded and industry standards are adhered to (Rebollo et al., 2014). Encryption protects sensitive data from illegal access, while access control enables businesses to create and enforce role-based access to resources. Monitoring and auditing capabilities in real-time allow enterprises to watch and analyze user actions, spot abnormalities and react rapidly to security problems. Lastly, continuous improvement is recommended to keep pace with the emergence of new security threats and vulnerabilities (Onose, 2023).

Systematic literature review methodology

This paper adopts the SLR technique proposed by Brereton et al. (2007). Previously published papers related to the cloud adoption framework were reviewed systematically to address a formulated question. The guidelines were adopted with a three-step review process that includes planning, conducting, and reporting. The milestone in systematic literature reviews is the explicit and clear definition of a review protocol in the planning phase that guides its execution. It aims to reduce researchers' bias and helps structure the retrieved results (Brereton et al.,2007).

Planning the review

Per Brereton et al. (2007) guidelines for conducting a Systematic Literature Review (SLR), the researcher first identified the need for the review and then created a review protocol consisting of five steps: define research questions, define the source of research, define criteria for inclusion and exclusion, define selection

procedures and define data extraction procedures. This protocol is to conduct an SLR on cloud adoption and framework studies, taking into account previous studies in this field.

Identifying the relevant literature

To determine appropriate search terms, this research utilized a technique recommended by Brereton et al. (2007) that involved two steps. First, relevant keywords, alternative words, and synonyms were identified using PICOC (Kitchenham et al., 2010) to address the study questions. Secondly, a table was created to classify the resulting keywords, taking into account any abbreviations or synonyms.

Table 1: Terms formed using synonym words

General Terminologies	Technology and Business Terminologies
Cloud Computing	Cloud services, virtualization, SaaS, PaaS, IaaS
Framework Adoption	Best practices, guidelines, standard
Use or Implementation	adoption, diffusion, acceptance, migration
Performance	Effectiveness, durability, scalability, ROI, competitive advantages

Finally, this study conducts a thorough investigation of previous research using the specified search terms:

- (Cloud computing OR cloud Adoption OR Cloud Framework) AND
- (Azure OR Google Cloud OR AWS OR SME) AND
- (Adoption OR use OR Implementation) AND
- (Performance OR competitive advantages OR cloud benefit)

To ensure high-quality results on the topic of implementing cloud computing frameworks, thorough searches were conducted on four databases (EBSCOhost, SpringerLink, and IEEE).

Selection of primary studies

The intention behind categorizing the criteria for inclusion and exclusion was to guarantee the usage of only pertinent articles in this research. The eligibility of each primary study was thoroughly evaluated by utilizing the specific criteria outlined in Table 2.

Table 2: Inclusion and exclusion criteria

ID	Specific criteria for evaluating the report	Score
S1	Is the research clearly focused on the cloud computing adoption framework	Yes (1 point)/No (0 points)
S2	Is the evaluation of the cloud computing adoption framework clearly described?	Yes (1 point)/No (0 points)
S3	Is the evaluation result analyzed or discussed?	Yes (1 point)/No (0 points)
S4	Are limitations and future implications for cloud computing adoption?	Yes (1 point)/No (0 points)

Inclusion/Exclusion criteria

The primary goal of quality assessment is to provide direction on how to interpret results and determine the credibility of chosen studies. To evaluate the quality of a study, its validity must be examined, which encompasses the validity of its scope, research publication, and comprehensiveness. This can be achieved

by scrutinizing the study's report, as suggested (Melegati & Wang, 2020). The study proposes ten reporting criteria, which are divided into general and specific categories, for assessing the quality of past study reports. The general criteria are broad and include the clarity of the research problem, research objectives and methodology, sufficient literature review, and clear reporting of results. The specific quality assessment questions used in this review study are presented in Table 3.

Table 3: Specific criteria for evaluating the report.

Include Criteria	Exclude Criteria
Organizational Level Study Qualitative, Quantitative, Mixed-Method	Individual Level study
Research published started the year 2013- the year 2023	It does not include research published before the year 2013
Language English only	Other languages not accepted
Full-text paper	Shorter than six pages, editorials, abstracts, and no peer-reviewed studies

Analysis

Keywords were used to obtain the relevant scholarly publications and abstracts indicated in the preceding section. The databases IEEE Xplore, EBSCOhost, and SpringerLink were searched methodically. Manually scanning the reference lists of downloaded papers for further relevant research that focuses on published articles over a ten-year period (2013-2023). After evaluating and scoring 50 papers based on predetermined criteria, 35 obtained a score of 1, and 15 received a score of 0. After conducting a full-text evaluation, however, only 19 of these publications were used for further review analysis, while 11 were eliminated owing to insufficient methodology and outcomes analysis.

Table 4: Publication List

Authors	Annotation
Peterson et al., 2015	[1]
Ardagna, 2015	[2]
Alenezi et al., 2017	[3]
Oral & Tekinerdogan, 2017	[4]
Chen et al., 2013	[5]
Nghihalwa & Shava, 2018	[6]
Wang et al., 2016	[7]
Skolmen & Gerber, 2015	[8]
Alassafi et al., 2019	[9]
Ezzat et al., 2011	[10]
Santikarama & Arman, 2016	[11]
Alemeye & Getahun, 2015	[12]
Singh et al., 2018	[13]
Liu et al., 2013	[14]
Albugmi et al., 2016	[15]
Utomo et al., 2021	[16]
Chang & Ramachandran, 2016	[17]
Saedi, 2016	[18]
Paredes-Gualtor et al., 2017	[19]

This section discusses in detail the essence of the SLR findings related to RQ1: Which Cloud Adoption Framework (CAF) can best help to identify and provide a roadmap for resolving many crucial problems that organizations face during digital transformation?

After reviewing the content of articles that are published in scholarly journals, there is no universal CAF that can serve any organization yet. Therefore, to comprehensively review and gain a better understanding of the literature on CAF, a holistic approach is required. The results of the Systematic Literature Review (SLR) can be broadly categorized into three distinct groups:

- Technology factors include cloud computing infrastructure, service quality, and security.
- Organizational factors include the organization's size, type, and culture, as well as the role of management in the adoption process.
- Environmental factors refer to external factors that may impact the adoption of cloud computing, such as government regulations, industry standards, and market trends.

Table 5: Categories

Factor	Source
Technology	[1] [2] [3] [4] [5] [6] [7] [8] [9] [10] [11] [12] [13] [17] [18] [19]
Organizational	[3] [10] [14] [15] [16] [18] [19]
Environment	[2] [4] [7] [8] [9] [10] [11] [15] [16] [17] [18] [19]

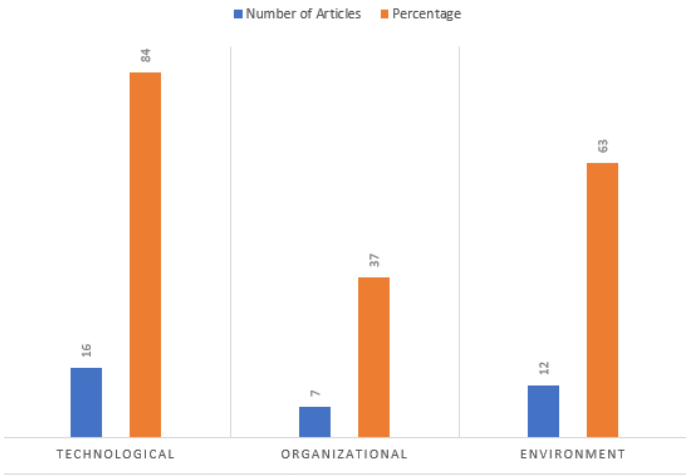

Figure 1: Distribution of Studies Cloud Adoption Framework

Technology is the most significant contributing factor to the adoption of cloud computing, accounting for approximately 84% of the overall influence. The infrastructure supporting cloud technology must be reliable, scalable, and secure to ensure effective usage. Organizations require adequate infrastructure in place to ensure their cloud computing systems meet these criteria (Wang et al., 2016). In addition to reliability, scalability, and security, service quality is a critical factor to consider when adopting cloud technology. Organizations rely on cloud services to provide efficient and uninterrupted access to their data, applications, and systems (Utomo et al., 2021). Therefore, service quality must meet or exceed the expectations of the organization (Singh et al., 2018) to ensure a smooth transition to cloud computing.

An additional crucial aspect influencing the adoption of cloud computing is the organizational size, type, and culture, accounting for 37% of the overall influence. Larger organizations with abundant resources tend to experience a smoother transition toward cloud computing, whereas enterprises possessing an innovative culture are more likely to adopt new technologies (Chang & Ramachandran, 2016). Moreover, management support is indispensable in addressing change resistance and ensuring a successful adoption process.

External factors, comprising 63% of the overall influence on cloud adoption, hold a second significant importance in determining the viability of cloud technology within an organization. Specifically, government regulations and industry standards are key factors that shape cloud adoption (Peterson et al., 2015). Regulatory compliance mandates specific data storage methods, which can either facilitate or hinder the adoption of cloud computing. Additionally, industry standards and market trends impact the perceived benefits and risks associated with cloud technology, further influencing its adoption (Alemeye & Getahun, 2015).

Discussion

Our SLR findings show that a range of technological, organizational, and environmental factors influences cloud computing adoption. By understanding these factors, organizations can make informed decisions about whether to adopt cloud computing and how best to implement it. Our analysis provides valuable insights for researchers, practitioners, and policymakers interested in cloud computing adoption. This section will examine the causes behind the lack of standardized CAF.

Different needs and requirements of organizations

Every company has a different set of necessities, prerequisites, and objectives, all of which influence the way it will utilize cloud computing (Pathan et al., 2017). The reduction of costs may be at the top of the list for certain businesses, while scalability, security, or compliance may be more important to others. As a result, a CAF that is appropriate for one company may not be appropriate for another organization (Skolmen & Gerber, 2015). For instance, a CAF that is intended for use in small and medium-sized organizations may not be appropriate for use in a major firm that conducts its business on a worldwide scale.

Diversity of cloud services and providers

The diversity of cloud services and providers has a significant impact on the CAF (Liu et al., 2013). As more businesses adopt cloud computing, they are faced with a variety of cloud service options and providers, each with its own features, capabilities, and price structures. This variation is causing organizations to reconsider their cloud adoption strategies and architectures, which has an impact on the CAF. With the enormous variety of cloud services and providers, one of the most critical challenges companies have is in selecting the appropriate combination of cloud services and providers to fulfill their unique needs. Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS) are among the numerous service types offered by various cloud service providers (Paredes-Gualtor et al., 2017). In addition, their pricing structures, customer service, and security features differ. This has demanded a comprehensive review of each provider's goods to decide which best meets the needs of a certain company.

In addition, the range of cloud services and cloud service providers influences the design of the cloud environment as a whole. Different cloud services and providers may have various degrees of interoperability, which may impact the creation and deployment of apps. Companies must also consider integrating many cloud services and vendors into a unified solution that meets their specific needs (Khan et al., 2017). The CAF is a framework designed to assist the systematic and consistent deployment of cloud computing by businesses. Nonetheless, because of the diversity of cloud services and providers, the CAF

must be agile enough to meet the evolving needs of organizations. It must be able to accommodate the variety of available services and provider options, as well as the varied corporate architectures (Salleh et al., 2018). Cloud Adoption Framework is significantly impacted by the range of cloud services and suppliers CAF. As enterprises navigate the complexity of the cloud world, their adoption plans and architectures are guided by the CAF. The CAF must be flexible enough to accommodate the varying needs of organizations and the range of cloud services and providers. Using cloud services necessitates a plan that includes the specific cloud service and cloud service provider. Hence, a CAF that is advantageous for one cloud service provider may not be useful for another.

Evolution of cloud technology

Cloud technology is constantly evolving, and new services, features, and applications are often made available. Thus, a CAF that was advantageous a few years ago may no longer be applicable now. Thus, businesses must regularly evaluate their cloud adoption strategy and modify their CAF accordingly. This modification has had a significant impact on the cloud adoption framework. As cloud computing evolves, it is redefining how firms operate and use technology.

The following are some of the most important ways advancements in cloud technology impact the cloud adoption framework (Salleh et al., 2018). The evolution of cloud technology has given enterprises more flexibility in selecting cloud services. Now that a greater number of cloud service providers provide a variety of services, enterprises may choose the cloud services that best match their needs. Companies may also combine public and private cloud services to meet their unique requirements. Cloud service providers continually improve their security measures to protect their customers' data (Sun et al., 2014). This makes it easier for businesses to adopt cloud services since they may have trust in the security of their data. In addition, cloud service providers give enterprises more advanced security tools, such as encryption, multi-factor authentication, and powerful firewalls, to secure their data. Cloud computing has decreased the cost for businesses to use computer resources (Singh et al., 2018). This is due to the fact that cloud service providers provide a pay-as-you-go model that allows businesses to only pay for the resources they use. Companies will no longer have to invest in pricey equipment and software, which may substantially reduce infrastructure costs. The infrastructure of cloud service providers is continuously upgraded to improve the performance of their solutions. This suggests that businesses that utilize cloud services may have enhanced performance and faster reaction times (Garrison et al., 2015). Organizations can now expect the same level of performance as with on-premises systems, making it easier for them to migrate their applications and data to the cloud. Cloud computing has made it easier for businesses to automate their IT processes. DevOps enables enterprises to automate the installation, operation, and monitoring of their cloud-based applications (Berman et al., 2012). This has made it easier for businesses to extend their applications and ensure that they are always available to customers.

The complexity of cloud adoption

Due to its numerous advantages, such as adaptability, scalability, and cost-effectiveness, cloud adoption has become a popular trend among enterprises (Zbořil & Svatá, 2022). Yet, implementing cloud technology may be difficult, and several factors should be considered prior to implementation. Choosing the ideal cloud service provider is one of the most important aspects of cloud adoption. With so many providers on the market, each providing a distinct set of services and pricing structures, businesses must carefully assess their requirements and choose a supplier capable of delivering their objectives within their budget.

For example, data security is another crucial aspect to consider while using cloud computing. While transferring data to the cloud, businesses must take precautions to safeguard it from possible assaults (Chang & Ramachandran, 2022). Implementing comprehensive security measures, such as data encryption and access limits, is critical.

In addition to security, integration is a crucial part of cloud technology deployment. Current apps and infrastructure must be compatible with the cloud. To enable smooth data transmission between the cloud and the current infrastructure, this may need extensive adjustments and setup work. Implementing cloud computing needs a transformation in culture. Workers must be taught how to utilize the new cloud services, and management must create new processes and procedures to maximize the benefits of the cloud (Iyer & Henderson, 2009). In general, cloud adoption is a complex process that involves much preparation and research. To deliver considerable advantages, the cloud must be connected with an organization's current systems and procedures. The advantages of cloud computing make it an appealing alternative for enterprises of all sizes. Choosing the appropriate cloud service provider, guaranteeing data security, connecting the cloud with current systems, and adopting a culture transformation may be difficult, though. Organizations may effectively embrace cloud technology and realize its numerous advantages if they properly analyze these considerations and prepare accordingly.

Recommendations

In today's rapidly evolving business landscape, cloud computing has become an integral part of enterprise operations. However, while cloud technology has numerous benefits, such as scalability, cost-effectiveness, and agility, adopting cloud services is not without its challenges. One such challenge is the absence of a single Cloud Adoption Framework (CAF) that can be applied universally to all organizations.

Indeed, each enterprise has unique demands, priorities, and objectives that require a tailored cloud adoption strategy to ensure successful implementation. Furthermore, the vast array of cloud services and providers, as well as the constantly evolving nature of cloud technology, add to the complexity of finding a one-size-fits-all CAF. Hence, it is essential for organizations to take a customized approach when it comes to cloud adoption.

Organizations should first evaluate their specific needs and requirements, such as business goals, existing infrastructure, data governance, compliance, and security. This evaluation should involve stakeholders from various departments, including IT, legal, compliance, and finance, to ensure a comprehensive understanding of the organization's needs. Based on this assessment, the organization can then develop a tailored cloud adoption plan that aligns with its priorities. The cloud adoption plan should include details on the selection of a cloud provider, service model, and deployment model that best suits the organization's specific requirements. Additionally, it should outline the organization's data governance policies, security protocols, and compliance frameworks, as well as the migration and integration process. A well-planned cloud adoption strategy should also incorporate a cost-benefit analysis and a roadmap for future cloud adoption and optimization. Moreover, successful cloud adoption is an ongoing process that requires continuous monitoring, evaluation, and optimization to ensure alignment with the organization's changing needs and priorities. Organizations should establish clear metrics to measure the success of their cloud adoption and regularly assess their cloud infrastructure's performance, cost-effectiveness, and security.

Conclusion

Adopting cloud services is a complex process that requires a customized approach. While there is no universal CAF that can be applied to all organizations, developing a tailored cloud adoption plan based on a comprehensive assessment of the organization's needs and priorities can lead to successful implementation. Furthermore, continuous monitoring and optimization are critical for ensuring long-term success and maximizing the benefits of cloud computing.

It is crucial to acknowledge that this review is primarily exploratory. It does not involve any quantitative or qualitative analysis. Rather, the study focuses on providing a conceptual foundation for future research that can examine the suggested framework in greater detail. While the current review offers valuable insights into the theoretical framework, it is essential to recognize that further research is necessary to examine that framework's effectiveness in practice. Specifically, future studies may include experiments that will assess the various frameworks' validity and reliability, as well as their potential limitations, as well as potential areas for improvement.

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