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Review Article

Descriptive Literature Review and Classification of Community Cloud Computing Research

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Cloud computing has been devoted to the development of recent advanced technology, aiding in improving a government's functioning and the services it offers to its people and organizations. It has achieved widespread popularity due to the rising number of benefits, including scalability, versatility, reliability, safety, confidentiality, pay-per-use, and dynamicity for the distribution of IT services. This paper explores a descriptive literature review and aims to classify the scattered communities involved in cloud computing research in information technology. This involves 51 referred published articles between 2010 and 2020 relating to the inception of community cloud computing by various organizations. Based on a systematic structured of reviewed literature and grounded theory approach, articles are categorized with respect to the eleven key influencing variables: cost, security, performance, QoS, trust, accuracy, ease of use, usefulness, architecture, framework, and model. Following that, those variables are comprehended into final one in order to envisage the community cloud computing adoption factors and concepts. This will consent for a strong examination of the community cloud computing phenomenon. The study is a novel attempt to demonstrate the differences in key factors for cloud computing in varying community settings and their causal relationships among the considered variables. The findings from the long-term systematic review contribute by assisting a collection of determinants for the penetration of community clouds services and potential adopters. It could serve as a basis for future directions and the development of theories in the exploring the community cloud computing in the field of information systems. This study contributes to identify various existing research gaps by providing holistic insights and future exploratory approaches that are anticipated to result in a robust unified structure for the adoption of community cloud computing services in the higher education institution (HEIs).

1. Introduction

Cloud computing has become an emerging technology involved in the provision of information technology (IT) solution services in recent years, which is interconnected and is a dynamically Internet-based computing service agreement between users and cloud service providers. It is widely growing popular across the world in the IT industry, which prosecutes greater opportunity in the business sector [1]. This technology offers numerous benefits, including cost savings, increased scalability, integrity, security, ease of access, and risk reduction for business [3]. Cloud computing systems have proven to be effective in meeting the varying demands for computing distributed sharing resources and services. This has become a revolutionary integral computing paradigm in the field of information technology, contributing significantly as an unprecedented computing power and flexibility in the distributed community computing to science, education, and research sectors in recent years [3].

The private cloud application as a community cloud permits its use for research and education purposes in a variety of institutions. Different types of applications and usage scenarios have also been explored including web applications, blog, web hosting, networking, and dispersed data storage services. Additionally, a cloud system of this

type can do provisioning activities in the form of computing infrastructure, software, and platform development to meet the demand of researchers or scientist's [4] It is also a technique in which users might access their own pool of computing resources in a network community [5].

Similarly, this research has shown its benefits in academic organizations, which has also been highlighted in this paper. The execution of parallel simulations was undertaken during the project's deployment, and the performance of the community cloud system was comparison functioning to that of the supercomputers [3]. Cloud computing is based on the fundamentals of distributed computing networks, service orientation, virtualization, grid computing system, and so on [6]. Further, the usage of grid technologies has also been introduced as a method for accessing cloud computing resources, enabling the monitoring and management of cloud resources.

Despite its benefits, cloud computing faces of several technical, management, and economic challenges, such as security and privacy [7, 8] and resource scheduling [8], that must be addressed,. Community is an integral aspect of cloud computing, and it is critical for its adoption and growth, particularly in the community cloud environment, which is highly accessible to users—considering that the community model is an advantage through perceived risks, shared resources, and saving costs. The community difficulties and challenges have been discussed in a variety of perspectives in cloud computing information systems [9, 10]. It has also been involved in security communication, resource distribution, security storage, and a variety of other facts of cloud computing [11].

Therefore, to deal with such problems, the need to implement better strategies arises, making use of community cloud computing one of them. The community cloud resides between the public and private clouds. The infrastructure and computing services, while like a private cloud, are not limited to one entity but are shared between two or more entities with common privacy, data integrity, security, identity, and regulatory considerations [12, 13]. However, despite the fact of the community cloud computing, the comprehensive and systematic review and background of the information about framework/model/architecture related to the community cloud adoption in HEIs is still the constraint that served as the primary impetus for performing this research. Therefore, the contribution of this study is to determine the community view in cloud computing with review the extant systematic literature review to identify the key frameworks/model/architecture. Furthermore, this study specifies which issues are being investigated and their relevant outcomes.

The structure of this paper is organized as follows: Section 1 is the introduction. Section 2 briefly discussed cloud computing and its characteristics. Section 3 explained related studies of the community cloud. Section 4 explains the methodology. Section 5 presented a detailed discussion. The final sections contain the conclusions and references.

2. Cloud Computing Overview

Cloud computing refers to "access to computing resources that are owned and managed by a third-party provider on a consolidated basis in one or more data center locations" [14]. Cloud computing is distinguished by on-demand provisioning and pay-as-you-use resource invoicing, with minimal upfront payment; cloud computing services minimize capital, transform running expenses into actual use, and lower staffing costs. It serves as a kind of application and a platform for providing computing services and infrastructures. The platform provisions configure, reconfigure, and de-provision servers as dynamically as required with the servers being virtual or physical machines. It establishes a paradigm shift from computing as a purchased product to computing supplied as a service to users over the Internet via huge databases or the cloud. The cloud infrastructure enables easily scalable, useful, virtually available, and customizable IT resources. Hardware support and maintenance for middleware and applications is not necessary with providing the cloud computing platform and service to users. Cloud computing is changing the development of the application and the way business decisions are taken [14].

Three common cloud services can be considered according to the different types of services offered.

(1) Software as a service (SaaS). In SaaS, the provider's applications on cloud infrastructure can be used by consumers, but they do not control the cloud networks, operating, and infrastructure. SaaS, considered a delivery model, will aid technologies supporting service-oriented architecture (SOA) and web services. Examples are Google's Gmail and Yahoo [12, 15].

(2) Platform as a service (PaaS). In PaaS, the provider's applications can be used by the consumer while deploying applications to the cloud infrastructure. This model offers the customer some control over the deployed applications but not the cloud infrastructure (networks, server, and storage).

    Examples include Salesforce's Force.com and Microsoft's Azure [12, 15].

    PaaS combines additional qualities such as built-in scalability, security, and dependability; facilitates developer collaboration; and ensures an uncompromised user experience. [16].

(3) Infrastructure as a service (IaaS). In IaaS, the consumer could use storage, network, and processes owned by the provider on-demand. The consumer can deploy and run the software. This model does not

give the consumer the ability to control the hardware cloud infrastructure, for example, Amazon's Elastic Compute Cloud (EC2) [12, 15].

2.1. Cloud Computing Deployment Models. Private clouds, public clouds, hybrid clouds, and community clouds are the four different types of cloud deployment methods available.

(1) Public Cloud. The public cloud is a type of cloud hosting whereby the cloud services are available in the open network for the public to use. This service may be offered for free or on a pay-per-use basis, for example, the Google App Engine [12].

(2) Private Cloud. A private cloud is a type of cloud computing concept that entails a secure cloud and a discrete cloud-based environment. This environment is entirely controlled by the given client. Private clouds that make use of actual computing resources offer computational power as a service within a virtual environment. In the model, the cloud or resources are available only to a single organization with greater privacy and control [14]. Examples of this are the VMware Private Cloud.

(3) Hybrid Cloud. This is an integrated type of cloud computing that involves the combination of private and public clouds [17]. Hybrid cloud refers to combining two separate clouds to form a combined cloud. It might be a mix of public and private cloud servers or it could be a mix of virtual cloud servers and real hardware. The many clouds are merged to provide a unified service [14]. The common type of combination is private data and the public cloud. Three key products are available are as follows: Azure, Microsoft System Center, and Windows Server.

(4) Community Cloud. When multiple organizations require identical infrastructure and wish to share it, a community cloud is formed. By pooling resources, enterprises may reap the benefits of cloud computing. The community cloud expenditures are distributed to fewer users than the public cloud, but not to a person or a tenant. Therefore, the community cloud is more expensive although it provides a high level of privacy, policy compliance, and security [14]. An example of the community cloud is the Gov Cloud by Google [12].

The remainder of this paper is structured as follows: The main literature related to community cloud computing is investigated and analyzed in Section 2 to address the frameworks, models, and architectures addressing various community cloud-related problems, an empirical analysis of the papers published during the period (2010–2020) is presented. The approach used is discussed in Section 3, and Section 4 summarizes the key findings. Finally, the conclusion presented in Section 5.

3. Community Cloud Adoption

A few architectures were suggested by researchers [18–32], as well as frameworks [33–44] and models [45–68] for the adoption of community cloud computing. The data set includes 51 articles that provided comprehensive frameworks, architectures, or models.

3.1. Frameworks. The article by Rodrigues studies a novel approach toward cloud architecture using the academic community cloud [13]. The two ways that can be used in the case of cloud burst or disaster recovery management are multicloud federation and cloud service standardization. The results reveal how the challenges and troubles faced due to old approaches can be solved by employing new ones.

These days, community clouds are used to save costs, and many organizations tend to use this service for their betterment [19]. Dubey et al. [19] offer a novel management approach for enterprises' use of community clouds. Additionally, IDA, a novel scheduling algorithm, was initiated. Research has shown that this system can improve the monetary cost of an organization.

Wahab et al. [20] illustrates how community-based cloud computing is a significant step in enhancing community services and networking, resulting in improved service management and resource utilization.

Yokoyama and Yoshioka's study [21] aims to perform new research on community clouds, with a particular emphasis on on-demand cloud extensions, which are typically built on remote sites for intercloud collaboration. The cloud on-demand approach enables the integration of private cloud computing systems horizontally.

In the current era of digitalization, Internet access is essential for all community members, and cloud computing systems need to be installed, especially in less developed areas and yearn for Internet accessibility [22]. The project shows that a community-owned local computing cloud can effectively be employed and sustained in a locality if appropriate tools and mechanisms are used.

Kawa and Ratajczak-Mrozek develop solutions for diverse businesses based on cloud communities and e-clusters [23]. The e-clusters are digital panoramas for collaboration that make use of communication and information technology. Using this information technology, the distances between widely dispersed networks can be reduced and the business process made effective.

Zhang et al. [24] study how community clouds provide a secure ambiance for organizations and business models. The risks of cyber incidents would also be mitigated and the decision-making within an organization improved.

The study conducted by Os and Bressan [25] demonstrates that for members of this environment, the concept of decentralized engineering is dependent on the community cloud's worldview, the creation of a heuristic function H, and research on mechanisms and policies for adapting physical and virtual networks to improve performance.

Valluripally et al. [26] propose a new community cloud infrastructure to make it possible for clinicians and scientists to increase accessibility from multiple sources to data sets, though it is also not compromised to ensure the data provider's security compliance.

Wu et al. [27] compare public and community clouds and propose a MeePo Cloud architecture. The results indicate that the MeePo Cloud architecture is well-suited for intensive big data sharing via digital disks and metadata servers.

The study presented by Baiardi and Sgan [28] provides the overlay of VMs, which helps manage a cloud more simply and easily. These specialized virtual machines (VMs) safeguard shared data and aid with the cloud community. Additionally, they oversee the cloud's infrastructure and are safe and dependable.

Filiposka and Juiz [29] provide a new model for the network architecture of the data center. The model has a large bandwidth and resilience. The result show that the cost and energy can be saved by modifying the structure of a community [30].

Selimi and Freitag focus on the attainability of application arrangements on cloud-based community frameworks. Tahoe-LAFS was used in conjunction with the cloud storage application to provide a graphical user interface and end-to-end encryption. Bit Torrent was also used, as it appeared to be better suitable for huge media storage files. The operation should be executed with real users where the community cloud will be the user's first choice [31].

The distributed file system on a cloud infrastructure attaching the Tahoe-LAFS and Extreme FS with their cloud storage gave a good end-user application with adequate security and privacy and web-based GUI. The importance of the distributed system lies in the interaction of users and providers, which gives dynamic results [32].

Mobile computing has been proposed for sharing and managing data across mobile communities. We can join the LAS service with the mobile communities by using the cloud infrastructure, and iPhone and Android phones can also benefit from it. Further research on it is essential for better outcomes as it is difficult to predict success in this field [32].

3.2. Architectures. The purpose of the study by Ojugo et al. is to investigate the benefits of a cloud framework for smartphones. Because of the study, it was determined that smartphones are vulnerable to attack. The Puch Cloud service thereby enables the users to hold the data by ensuring a backup. This system also allows users to solve security-related issues, with the data being recovered via a remote server [33].

Baig, Freitag, and Navarro studied and explained the upcoming computers system [34] that the emphasis is on CCs, or community clouds. The creation of the guifi.net community network has been cited as a successful example of digital infrastructure development. CCs can efficiently serve CN members by increasing the quality of existing services.

Alsaghier et al. [35] suggest based on the DRM community cloud (DCC) and the banking community cloud, a stable and lightweight protocol for mobile digital rights management (DRM). Using the wireless public key infrastructure, universal client-side integrated circuit board, DRM community cloud at the cloud provider, and banking community cloud, the non-repudiation property is attained.

In a cloud computing context, Ahmad et al. [36] suggest parallel virtualization. The authors sought to optimize the community cloud's hardware, cost, and workload while enhancing speed and performance.

In this rapidly developing era of digital objects, the Internet and IT technology have made it possible for communities to communicate more efficiently and effectively [37]. The costs of the networks have also been lowered, and local interests are served. [37].

Wen et al. [38] divided the cloud service part into many cooperative communities using the technique for community finding. The data indicate that using a community partitioning strategy improves the success rate of cloud services.

Zhao and Yang [39] proposed to include a bandwidth warranty for the sharing of social media content. The results showed that BRAC is efficient and effective in meeting social multimedia content bandwidth requirements and enhancing bandwidth usage.

Petri et al. [40] studied social community clouds and social clouds that are becoming a new environment where users can trade resources by social networks. The study finds the revenue as a metric affecting number of peer nodes [40].

According to Sus et al., climate research can be conducted using a community cloud structure based on several satellite image sensors. The findings demonstrate the system's versatility as a way for passive satellite sensor data generation from cloud objects. [41].

In many fields, such as education and research, the community cloud CC has emerged as a swiftly developing notion [42]. The business processes (BP) that facilitates the functioning of an organization plays an important role in community cloud. BP helps the community members achieve the activity flow in an organization for specific requirements. CC application tends to affect the efficiency of business processes.

Li [43] discussed the mechanism of fast collaboration and the method that used in process drive. Additionally, it is referred to as community cloud computing, and it provides a novel foundation for workflow systems. It enables structured and rapid communication, as well as a scheduled approach dubbed unified scheduling strategy.

3.3. Models. A self-coordinated cloud working framework can be fabricated and can convey a really circulated multicenter framework support. Its adaptability features the benefits of this client-driven cloud engineering. Traditional IaaS, PaaS, and SaaS can be altered to include angles as client claimed foundation, administrator less cloud stage, and character-driven data handling and capacity [44].

Mohan et al. [40] propose COMPAC (A Community Cloud Pricing Model) depending on the cost of services being offered. A web-based pricing tool was proposed and is available for use by other suppliers. Indian Banking leverages our pricing strategy to launch the country's first public cloud. The use of the group cloud has increased facilities [45].

Shirazi and Iqbal [46] focuses on analyzing m-commerce-related privacy problems. It encompasses the aspects of privacy and privacy expectations. This overviews current models, including innovations that design enhances privacy. The result shows that it can be achieved through socio-cultural solutions to fix privacy. Trust and security can be a mixture of technology and business policies [46].

To improve the user interest in cloud computing, Yoro and Ojugo propose a client-trusted security system. The suggested architecture includes a user-centric virtual process paradigm for cloud computing security. The results show that the ability of the proposed framework to increase the user's trust level by 67% [47].

The wireless networking service has proven to be a cost-effective IP networking infrastructure service in the less developed areas [48]. Providing services and applications by deploying their availability in these areas through a wireless network can be extremely helpful for the users.

Baig, Freitag, and Navarro focus on the research model of cooperative edge cloud deployment. The project demonstrated how the container method used in this community cloud system enabled community members to exchange services via the networking edge [49].

Another work by Hao et al. [50] proposes a social collaboration model for a two-layer multicommunity cloud cloudlet to allocate subtasks to community clouds in mobile edge computing. The findings show that the proposed algorithm will reduce the number of access costs, the sum of monetary costs, the consumption of electricity, and increase the level of protection.

For large-scale distributed infrastructures, the most significant procedure is cloud computing [51]. The use and application of an energy-aware brokering algorithm in a community cloud ecosystem can result in improved performance and increased sustainability. Several metrics were taken into account. This will also take into account the cost-saving element of using this method.

MC3 (Multi-Community-Cloud Social Collaboration Model) is a model that selects the most efficient, secure, and trustworthy tasks to complete complex tasks. The model is optimized in four ways: minimizing the cost of access and monetary costs and optimizing the agreement at the security level and confidence between group clouds. [52].

The world is rapidly progressing concerning IT systems and applications. When it comes to big companies, many must encounter challenges regarding the changing environment [53]. Cloud computing has proven to enhance the IT infrastructure for various companies. The companies can improve their ability to integrate within the supply chain by investing effectively in collaborative capability.

The model presented by Al-Mashat et al. [54] acts as a mediator between service providers and customers in a community in order to offer them with the best possible assistance. Through the usage of this system, end-users will be able to select the services that are most appropriate for their needs and preferences. Furthermore, it was verified that the quality of service offered was of a high enough standard to be relied upon by the users.

According to Khan, Freitage, and Rodrigues [55], the community clouds use user-contributed resources either through the user systems or augmentation with existing cloud infrastructures. The aim is to integrate the various options available in the cloud computing model with the help of resource availability to satisfy users' critical needs and interacting with them in long term [55].

Container-based virtualization is used to build a multipurpose execution environment on a single computer to address the issue of resource sharing in low-capacity systems. A single system can be built to give the user and the community with a multipurpose environment for isolation and security of community cloud resources while also providing the user with a single point of contact. The finding reveals that community networks are underutilized and that resources might be allocated to provide more services to more people [56].

Big data clusters on community clouds could benefit from this efficient and cheap resource distribution approach. In a quasi-real-time mode, tested with OpenStack-based community cloud tests, and SERAC3 is able to smartly pick a configuration within 2.2% of the exact optimal solution, saving around 80.1% of search costs compared to an exhaustive search. [57].

Liu [58] et al discussed the application of Swift as a system operating in a data center cloud environment. Usually, the community clouds that are established on a community network require a dispersed ambiance to serve. The result shows the functioning of Open Stack in a community setup. The most simulated environment was developed while working on the project, and the important community environment factors were used in the process.

The study by Saovapakhiran and Devetsikiotis inferred new confirmation control and directing algorithms in community clouds, advancing benefits while apportioning the extreme assets, subject to the SLA requirements. Additionally, they presented the idea of social evaluating and consolidated it into the algorithm to help the system focus on the appearances and control disappointments [59].

Cloud computing was proposed in the Garlick research proposal for data preservation. The loss of data by a sudden event can be disastrous for a company. Community cloud is also like public cloud, but both have their pros and cons. So, the main aim for business resilience is to get the data recovered after catastrophes damage [60].

Ren et al. [61] considered a community cloud that performs real-time stream mining across a wireless network for many users, addressed the problem of dynamic resource provisioning, and developed a selection and frequency algorithm that can achieve an arbitrary close-to-minimum average energy classification cost for each customer, thereby satisfying the average power restriction.

The study conducted by Keung [62] aims to enhance BIM with the help of the cloud community. It can solve many problems of BIM. First, in the construction market, they will remain competitive. Second, privacy problems and interpersonal interaction can be readily resolved through virtual interaction. Finally, a virtual communities focused on the cloud can increase productivity and collaboration. It can ease storage and increase the efficiency of BIM [62].

Khan et al. [63] applied different valuing instruments from the writing to transfer speed designation issue of cloud applications in the community network, examined their effect on the social government assistance and honesty.

The Web 2.0 is used to transfer patient information between the doctor, nurse, or caretaker. The study by Shirazi [64] proposes a home care system (HCC) that transfers information with the help of sensors, and it uses a cloud computing system. There are many drawbacks of this system as well.

Mullins et al. [65] explore the efficacy of a protocol for allocating lightweight resources in the allocation of services in a heterogeneous environment consisting mainly of low power nodes. The authors show that services can be provided on nodes with the correct resource brokering strategy without adversely affecting individual nodes in the network where the least effect on overall performance is achieved.

Jimenez et al. [66] conducted research on the expansion of community networking using community clouds. These clouds can boost the usage of many applications and provide many facilities at one point. In guifi.net, the extension and application of existing platforms and systems are available to deploy applications on clouds.

The study by Zhao et al. [67] discusses the problem of developing community-based cloud computing, specifically problems of resources' trading. Community-based community provides one-to-one communication to many users at once. The result showed that multiagent-based optimization improves the decision in the trading selection process.

Deebak and Al-Turjman proposed an integrated plan to develop collaboration between trusted neighbors. The test included three real-world data sets, and the results showed remarkable improvements in the traditional system [68].

4. Methodology

The aim of this paper is to conduct a systematic review of the literature to reflect the current state of IS research on community cloud adoption. This review process adhered to the manner of [70] basic guidelines for performing an efficient pertinent literature review, the query from papers was identified in those released between 2010 and 2020 with selected search keywords. A total of 51 publications were selected and added into the study based on their relevance to the research area from the first search, in accordance with our selected paper criteria.

A key strategy is to frame research questions and then select articles from within the domain using conceptualize research areas and survey and synthesize past research in line with the identified research gaps [71–73]. This comprehensive literature review provides a pictorial depiction of published results in linked study areas. The first stage is to define the research question and to take advantage of the chance for a review. All papers on community-based could computing are then searched for the primary stage. After that, all of the reviewed papers are categorized so that the relevant ones may be identified. Cloud computing research is then categorized and conceptualized through data extraction. Finally, these various approaches were used to produce a community-based cloud computing research theme.

4.1. Research Questions. For a systematic review of relevant literature, the study primary goal is to gain an in-depth understanding about the type and quality of existing research in a particular field and where it has been published. It is important to consider all these influencing factors while formulating the research questions. The following major research questions (RQs) are framed in accordance with the research gaps listed below to attain the study's objectives.

RQ 1. What is the proposed approach used in the researches?

RQ 2. What are the community cloud factors?

RQ 3. What are the limitations of the researches?

4.2. Conduct of Search and Selection Process. When conducting a review, the search phase is typically the first step in the process. The search for primary studies is typically carried out by exploring significant databases. Searching for publications on digital libraries was an important phenomenon for this systematic literature analysis. The significant databases were only incorporated because of scientific indexes and their high impact factor. Using this search query, researchers were able to find information on interventions, comparisons, and outcomes. The title of this study was analyzed to determine the keywords that would be utilized in a search. Cloud and computer science search results were involved into this study.

The selection criteria used in this study are critical since they ensure that only relevant papers are reviewed. Hence, the inclusion and exclusion criteria were used to select relevant publications in the domain of community cloud computing policy and research classification. According to this selection criteria, abstracts with little or no specific relation to the subject matter, as well as articles describing study summaries and the like were excluded in this selection process. It was decided to focus on cloud computing and the community domain in the primary investigations. For this study, a fundamental literature review on community cloud computing is the main wording for this work.

4.3. Data Extraction and Publication Statistics. Articles relevant to the community cloud computing strategy were grouped into different classifications schemes.

The results of a review of 51 publications are reported in four dimensions: article distribution across the year, publication sources, research methodologies used, and cloud

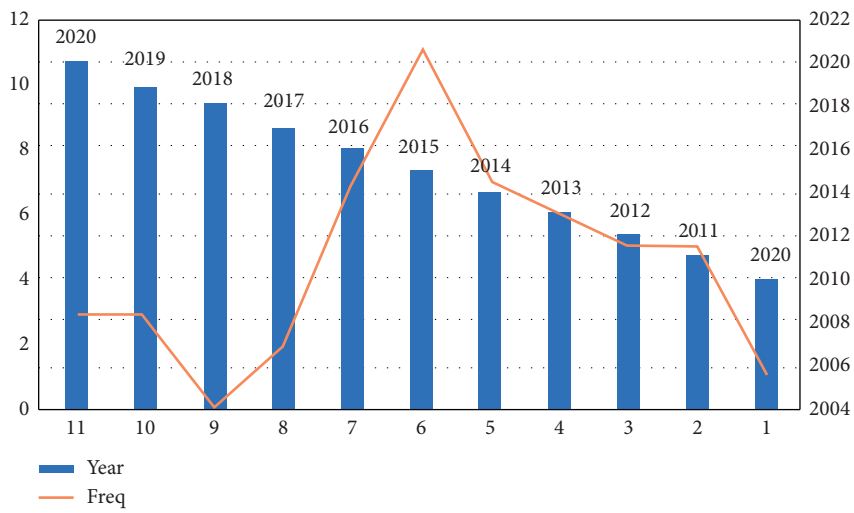

Figure 1: Distribution of articles per year.

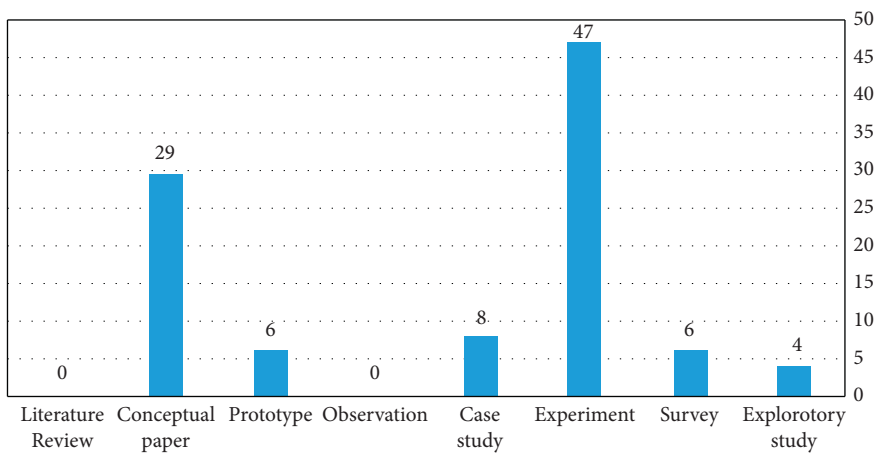

Figure 2: Summary of research methodology base on identified articles.

computing adoption factors and concepts. From 2010 through 2020, interest in exploring community cloud computing adoption has increased enormously, as depicted in Figure 1; however, the frequency did not the follow the similar trend of community cloud interest phenomenon.

5. Discussion

The study mainly focuses on community cloud computing and systematic research approach based on articles classification theme. The research may necessitate identifying the sources of publishing. Graphs and tables used to analyze the outcomes of the reviewed papers allowed us to determine which study topics and kinds lacked sufficient articles. It was found that certain topics had a high number of papers devoted to them. This study took into account variables such as security, cost, and performance linked with cloud computing as well as community cloud factors and research technique based on specified article categories.

5.1. Applied Approach. The results indicated that out of the 51 identified articles, 47% undertook experiments, 29% displayed conceptual papers, and 8% were case studies on the implementation and use of community cloud services, 6% was prototypes and surveys, 4% was exploratory studies, and the total data set is as shown in Figure 2. In comparison to quantitative studies, the findings show that qualitative studies have contributed less to understanding community cloud computing factors and concepts. In comparison of the identified articles, more articles were published on experimental, and conceptual research; however, minimum articles were published on prototype, case study, survey, and exploratory study. On the other hand, there were no articles on observation and literature review scheme. A quite consistent study conducted by the [74, 75] on the cloud computing literature review and they concluded the similar finding which aligned with current study.

There are several interesting facets of this cloud computing community research. For evaluation and validation

Table 1: Community cloud factors.

(Concept)	(Factors)		
	Architecture	Framework	Model
Cost	[18, 19, 22, 23, 26, 27]	[33, 36]	[46, 47, 49–51, 53]
Security	[24, 25]	[33, 35, 37]	[45, 46, 50, 55, 56]
Performance	[14, 20, 21]	[33]	[53, 56]
QoS	[14, 20]	[37–39], [40]	[55]
Trust	—	—	[46, 50, 55]
Accuracy	[15]	—	[51]
Ease of use	—	[37]	[46, 53]
Usefulness	—	[37]	[46]

Table 2: Summary of limitations presented in adopting community cloud computing.

Concept	Limitations	Ref
Architecture	Expect to completely support Oracle-VM and suggest frameworks to demonstrate real-time resource savings and automate network border protection	[18]
	Additional security solutions for the cloud service provider are also considered to find out the cost variation, length, and other parameters in the real cloud environment	[19]
	It can be expanded to reduce the dependence on the master as a trustworthy central agent regarding the misbehavior detection system and includes a tri rather than binary classifier based on the gravity of their threats	[20]
	This architecture can be extended to broad-area networks using SINET L2VPN and VPLS services	[21]
	Components are being developed to calculate and account for contributions to and usage of the cloud CPR	[22]
	More on other model options to explore the model's local functions, which are currently missing from OpenStack	[24]
	Best practices can also focus non-experts with more intuitive user interfaces to query using parallel programming APIs in high-performance computing quickly	[26]
	It is needed to update community cloud systems to support several organizations The cloud protection structure of MeePo should be applied to multiple levels Using strong authentication to advance the protection of data creation, and transition	[27]
	(1) Physical attack protection so that it is not appropriate to trust the cloud provider and the cloud administrators (2) Explore how redundancy can be transparently introduced into an overlay without migrating a VM to cover hardware component faults	[28]
	To focus on a deeper investigation of the possibilities for performance boosting based on populations and other network metrics	[29]
	To extend the experiments and real use as the end-users become active	[30]
	Study for an in-depth understanding of mobile community specifications, the implications of cloud computing infrastructure and mobile communities	[32]
Framework	The contribution to and utilization of cloud CPR is measured and accounted for in order to be able to spread the costs equally and facilitate reinvestment, and the ability to identify and mitigate risks	[34]
	The BAN logic and scyther instrument are used to validate the proposed protocol	[35]
	To examine the cloud providers' non-functional functionality for the discovery and optimization algorithms of the cloud service community	[38]
	Another noteworthy concern is the replica selection process as in the next step	[42]
	The scheduling method will be further enhanced to use a fast collaboration process and other associated workflow system application improvements	[43]
Models	Pricing for PaaS and SaaS can also be further enhanced because of the service's differential value and can be dependent on transactions/use.	[45]
	Focus on this architecture's full-scale implementation and how the cloud can be protected from the deliberate malicious behavior of the cloud provider	[47]
	Includes multi-service implementations, reliance on the docker center, and ease of creating docker files	[49]
	Extend the proposed model to other cloud server services and applications in the community	[50]
	Explore a strategy to balance sustainability intelligently with many other success indicators	[51]
	Investigate the effect of the mutual implementation of internal and external integration activities on organizational efficiency	[53]
	Identify configuration or security problems that could affect the services' efficiency.	[56]
	The assessment as a real community of OpenStack swift cloud implementation is needed	[58]
	To get input from the involvement of end-users to further form the creation of the components of the group cloud	[66]
	To determine the normalization and user attributes, create a suitable testbed	[68]

research, it is important to note that there are indications of a lack of publication in particular domains. Using cloud computing to do research is a boon for researchers since it allows them to synthesize and display their findings in a way that piques their interest. Because it is so easy to discover the gaps in many areas of study, a community cloud computing scheme without conducting a follow-up systematic literature review offers a unique value of its own. It has been shown in this work that there is a dearth of community cloud computing studies that have been conducted in a systematic manner.

5.2. Community Cloud Factors. In this study, community cloud are influenced by many factors, including, cost, security, performance, QoS, trust, accuracy, and usefulness [76] as shown in the following Table 1. In addition, eight areas were also discussed in terms of tools, models, and methods as well as in terms of the evaluation and validation of solutions, as well as in terms of the evaluation of philosophical and subjective research. The observation is in alignment with the funding obtained by [77] in their studies on the systematic literature review on cloud computing factors evaluation.

5.3. Limitations of the Research. The following Table 2 shows the limitation of previous studies that adopted community cloud computing.

Based on earlier studies, there is a problem to determine the factors affecting the adoption of community clouds in higher education institutions from a decision-maker's perspective. The analysis concluded that cloud computing technology provides higher education institutions with great opportunities and a need for a centralized, well-structured framework. Different institutions of higher education are deploying this cloud computing system. In addition, there are some limitations in previous studies that are as follows:

(1) Consider security services for the cloud service provider [22].

(2) Make span to evaluate other factors [22] such as cost, availability, security, privacy, adequate resource, compatibility, ease of use, usefulness, integration, environment factors, complexity, QoS, and resource access.

(3) Investigate the influence of the adoption of community cloud on operational performance factors [50].

(4) Understand the factors that mitigate the risks [59], such as privacy, availability, and confidentiality.

Based on these gaps, this work will cover the development of the proposed standard comprehensive community cloud framework using technology, organization, environmental, human, security, and advantages factors. There is a need for a well-structured conceptual framework to be applied by different Saudi HEIs. This study involves the construction of a conceptual framework that considers the technology, organization, environment, people, advantages, and security that various Saudi HEIs could apply.

6. Conclusion

This paper performed a systematic literature review on community cloud adoption and the usage of community cloud technologies in various sectors. An extensive analysis was carried out from journals and conference papers that have been issued during the time (2010–2020).

A systematic review of the literature was utilized to find and collect the necessary research papers. The study concluded that community cloud computing technology offers great opportunities to higher education institutions and that a centralized, well-structured system is required. Various higher education institutions are implementing this cloud system. The contribution to the field is the direction for future research on the adoption of community cloud, to support the overall growth of IS theory and to expand their research and understanding of adoption decisions. Second, we offer guidance to practitioners on the design and implementation of community cloud services. This research offers valuable insights for both cloud service providers and companies exploring the application of technology.

7. Limitations

This study has concentrated on a systematic literature review to different designated areas lacking in studies in terms of community cloud regulation in a wider range of end users. The major limitation of this study is that the initial search consisting of small number of articles; however, the numbers of search articles should be increased a lot in varying identified subject areas with community cloud factors. A decision-point makers of view is needed to identify the elements influencing adoption of community clouds in higher education institutions.

8. Suggestions for Future

8.1. Work. This study found that community cloud technology provides great opportunities and requires a well-structured centralized, unified framework for various HEIs to incorporate the cloud. Based on this paper, further work will involve designing the proposed unified integrated framework that uses adoption technology with numerous factors and considering the previous limitations. This systematic literature search process is restricted to journals, conferences, and book chapters. As a result, only a few dissertations and other electronic media sources, such as periodicals and newspapers, can be considered for future work.

Unfortunately, due to the connection constraints, bandwidth and data transmit, data processing and synchronization, and distributed nature of community cloud computing environments, various problems regarding community cloud computing environments still needed to be resolved as future challenges.

Data Availability

The primary and secondary data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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