

## Systematic Literature Review on Cloud Adoption

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### Abstract

While many organizations believe that cloud computing has the potential to reduce operational cost by abstracting capital assets like data storage center and processing systems into a readily on demand available and affordable operating expenses, still many of these organizations are not aware of the factors determining the performance of cloud computing technology. This paper provides a systematic literature review focusing on the factors determining the performance of cloud computing. In trying to come up with this review, the following sources were searched for relevant articles: ScienceDirect, Scientific.Net, ACM Digital Library, IEEE Xplore, Springer, World Scientific Journal, Wiley Online Library, Academic Search Premier (via EBSCOHost) and EdITLib (Education & Information Technology Digital Library). In first search strategy, approximately 100 keywords related to the research domain like; "Cloud Computing" and "Cloud Services" were used. In second search strategy, 65 keywords more related to the research domain were selected. In the third search strategy, the primary materials were identified and classified according to the paper types (Journal or Conference), year of publication and so on. Based on this study, twenty (20) factors were found that determine the performance of cloud computing. The IT organization needs to consider these twenty (20) factors in order to adopt cloud computing.

**Keywords:** Cloud Computing, Cloud Adoption, Cloud Performance, Cloud Impact, Organizational performance

## 1. Introduction

Nowadays, cloud computing is an ideal technology for small and medium business organizations [1]. This technology offers an opportunity to small and medium business organizations to have access to infrastructures that they cannot afford to buy. It also helps them to adopt this technology and compete with larger businesses in the market [2-5]. Statistics shows that until 2013, there were 2.4 billion cloud computing services users all over the world but 78% are from the developed nations like USA, UK, Germany etc. and is projected that approximately 3.6 billion internet users are expected to access the cloud services by the year 2018[6].

Cloud computing services are used in E-education, E-health, E-commerce, E-business, and supply chain. It has been noticed that most of the organization who have adopted cloud computing technology are not aware of the factors determining the performance of their organizations [5]. In fact, in order to adopt cloud technology an organization needs to know and understand the factors that may increase or decrease its

performance after cloud adoption. Thus, this systematic review examines the cloud computing literatures with a view to identify factors determining the performance of cloud computing services. Based on this literature review, we have identified twenty (20) factors determining the performance of cloud computing.

This review also identified that barriers affecting cloud adoption significantly from one country to another depending social, political; economic and technological development of that country but generally the adoption depends on the country's level of business and economic development issues [7]. Effective awareness, reliable power and broadband connectivity has been identified as major barriers to effective utilization of cloud services by many organizations.

In this systematic review, 56 articles from 2010 to 2015 were identified as primary studies. Majority of these articles were published in indexed journals followed by a few conference proceedings also published in indexed journals.

Next section presents an overview of cloud computing which begins with cloud computing service models.

## 2. Cloud Computing Service Models

Cloud computing technology and its service providers offer the services based models so that customers can choose based on their organizational requirements [8-10]. There are three service models quite popular in cloud computing:

### 2.1 Infrastructure as a Service [IaaS]

IaaS provides its subscribers an opportunity to access infrastructures and services such as processing power, storage area, networks, and other resources provided by the service providers [8-10]. In this case, the cloud infrastructures are managed by the service providers [10]. Subscribers or users utilize only the services they pay for and are not allowed to have access to the other unpaid resources [11]. The model provides economical service utilization since end user need not to buy the whole infrastructure instead the services is paid based on the usage (on demand). Figure 1 illustrates the Infrastructure as a service structure.

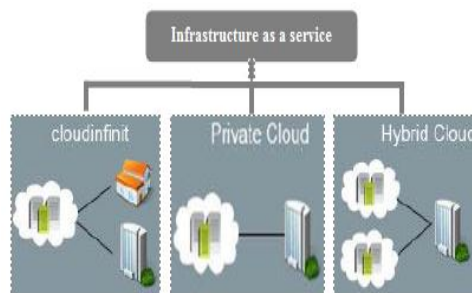


Figure 1. Infrastructure as a Service [IaaS] Source [11]

### 2.2 Platform as a Service [PaaS]

This service model gives its users an opportunity to develop software and deploy it onto the cloud infrastructure. The users can create or acquired applications using programming languages and tools supported by the service provider [9, 12, 13]. The user can design, tests and deploy software across the cloud platform [11]. Generally, this indicates that users have control over only the tools, applications development and testing environment but the infrastructures that help them access the tools, development and testing

environment are managed by the service provider. Figure 2 below shows Platform as a service structure.



Figure 2. Platform as a Service [PaaS].Source [11]

### 2.3 Software as a Service [SaaS]

This referred to as software distribution model [14]. This service deployment model gives its users an opportunity to use the service provider's applications (software) available in the cloud technology [9, 13]. Once a user subscribes, the service can be accessed using various client devices through the provided interface [13]. This also gives users an opportunity to have access to the available software online instead of buying and using it locally at their host computers. Users pay only the service fees instead of the application license [15]. The software are centrally hosted and used on demand [16]. This differs from the traditional software distribution method, Software as a Product[SaaP] in which user has to buy the software license and install it in his/her device even if the user needs it for a single use[17]. The structure of SaaS can be seen in figure 3 below.

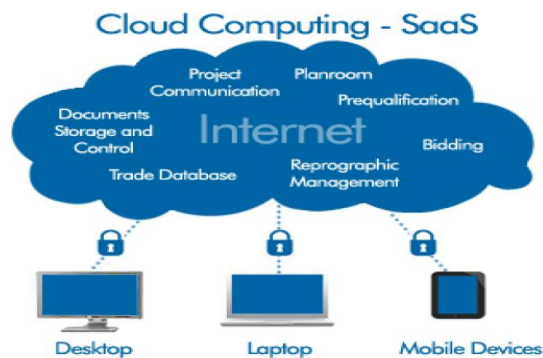


Figure 3. Software as a Service [SaaS].Source [11]

### 2.4 Cloud Computing Service Deployment Models

While service models focus on the specific capabilities of cloud solutions, the deployment models describe where, how and by whom the cloud's physical servers are managed [18]. Cloud computing may be deployed as private, public or hybrid, with the choice determined by the user's desired levels of control and performance[19]. In cloud computing literature, the following models have been identified for service deployment.

#### 2.5 Private Cloud

In this model the infrastructures of cloud computing is acquired and managed by a particular organization

and the service is not shared with any other organization[20]. In some instances, organizations may decide to use the service provider to administer entire segment of infrastructure, servers or storage infrastructure[21]. This arrangement is called a managed private cloud. Private cloud is always viewed as the one with high performance, more security and provides better service delivery since the resources are not shared with any other organization[9].

## **2.6 Public Cloud**

In this model the cloud infrastructure is made available to individuals or organizations by provider organization for a fee[22]. The service is being paid per usage[12]. Resources like storage, software development platform could be provided [23]. That means services are provided to the general public by the service providers to subscribe and pay for the amount of service they consumed [24]. For example, the following cloud services are available for public usage: Amazon Elastic Compute Cloud (EC2), IBM's Blue Cloud, Sun Cloud, Google AppEngine and Windows Azure Services Platform [9, 15, and 25].

## **2.7 Community Cloud**

In this service architecture the infrastructure is shared among some organizations [26]. It usually serve those organizations that have common polices, objectives, aims and concerns [7]. It can be managed by the organizations or a third party that provides the required services[25]. The organizations share among themselves the burden of maintaining the services e.g. cost, monitoring, maintenance etc.[15, 27]. The collaboration can also be done in order to cut down the service cost[15]. In community cloud, two or more organization with similar concerns area (for example security, storage) may decide to join hands and implement a cloud infrastructure for solving their common problems.

## **2.8 Hybrid Cloud**

This cloud computing service deployment model combines two or more of the above mentioned models [27]. Organization may decide to manage some resources like storage in their data center and a third party may manage the other resources for the cloud computing, example applications[7, 9]. Organization may also decide to use private cloud services for customers' data and maintain public cloud services like Amazon Elastic Compute Cloud [EC2] for other operational data [25, 27]. This shows that an organization may decide to maintain a combination of cloud deployment models example, Private cloud and public cloud in one organization for different business purpose. Next section presents the key characteristics of cloud computing as outlined by National Institute of Standards and Terminology.

# **3. Key Characteristics of Cloud Computing**

The five key cloud computing characteristics defined by National Institute of Standards and Terminology (NIST)[28]are outlined below.

## **3.1 On Demand Self Service**

A user could subscribe a service that requires no human interaction and the service is utilized only when needed [29]. Depending on the current demand, the user may request for the service and quickly release the resources when the task is completed [7]. All subscribed resources will always be available but the user utilizes them only when their need arises[15, 18]. This gives user some degree of flexibility as well as the resources that are not tightly coupled with a single user.

### 3.2 Broad Network Access

Broad network access in cloud computing means a user can broadly access resources via network from almost everywhere using different devices like laptop, palm top etc.[7, 20, 30]. In this characteristic, one can figure out that cloud computing provides wide range of access to the clients and variety of devices in which different platforms can be used to access the services.

### 3.3 Resource Pooling

This characteristic refers to cloud computing ability to provide services and resources, physical or virtual to user irrespective of whether the user knows where the services are coming from [31, 32]. The user does not need to have knowledge about the location of the provided resources [6]. This means a collection of services and the service providers' pool resources in order to serve multiple clients irrespective of their physical locations or service needs.

### 3.4 Rapid Elasticity

This characteristic of cloud computing refers to be rapidly scalable [5]. Provision of service and resources are based on the user needs. The services are dynamically subscribed [17]. This can be viewed as another term for scalability, which means depending on the demand, cloud computing provides its user with ability to scale up or scale down the service or resources subscribed. In other words, rapid elasticity in cloud computing means a user has full service subscription flexibility and control over the subscribed services and infrastructures.

### 3.5 Measured Service

Resources and service usage can be monitored and reported [33]. Cloud computing provides a user with monitoring capabilities to measure the amount of services and resources that are utilized at any time [34]. This characteristic made cloud computing to become a service driven innovation in a way that its consumer subscribes to the service and resources based on the need and its usage. A consumer may decide to buy a service just the time they need to use the infrastructure or just the storage space they need for a specific period. The following section discuss the benefits of cloud computing adoption to IT-organizations

## 4. Benefits of Cloud Computing Adoption to It-Organizations

Cloud computing offers number of benefits to IT-organizations [35]. The benefits differ from one organization to the other. It is possible that what a particular organization viewed as benefit may not necessary be such in another organization [36]. The benefits help these organizations achieve their targeted business or operational goals. These benefits include Pay As You Use (PAYU)[37], fast deployment, flexibility and lower costs of operations. However, the benefits includes scalability[14], automatic software update, rapid provisioning, increased collaboration[16], and rapid elasticity[38]. Rest of the benefits are: competitiveness, ubiquitous network access, environmental friendly, protection against attacks[39], low cost disaster recovery and data storage solutions[40], on-demand security controls, real time detection of system tampering and rapid re-constitution of services[41].

The following section presents challenges of cloud computing adoption in IT-organizations

**Table 1. Existing Work**

| Author/Year | Title/Area  | Factors   | Research Findings   |
|-------------|---|---|---|
| [45]        | A Study of Barriers and Their Impact on Cloud Computing Adoption  | Cloud adoption, satisfaction and current state of cloud computing use and motivations among IT organizations.   | The findings of the research shows that 57% of the respondents adopted cloud computing in the last three to five years.   |
| [46]        | An analysis of security, cost-effectiveness, and it compliance factors influencing cloud adoption by it managers          | Analysis of security, cost-effectiveness, and its compliance factors influencing cloud adoption by IT managers. | The findings of the research indicated that the decision to adopt cloud computing technology depends on managers' perception in terms of security and cost-effectiveness.   |
| [47]        | Cloud implementation in organizations: critical success factors, challenges, and impacts on the IT function.              | Critical Success Factors for cloud initiatives: business value, technical performance, and project delivery.    | A successful cloud adoption should allow an organization to lower costs, market new services rapidly, meet business requirements, simplify IT operations, and e accepted by end users. It should ensure that system migration and integration is within budget and on time. |
| [48]        | Examining the Relationship between Technological, Organizational, and Environmental Factors and Cloud Computing Adoption. | Factors that relate to and may influence IT managers' interest in adopting cloud computing.                     | The research discovered 132 factors that helps how decisions are really taken and alert IT managers to some of the invisible strings that must be considered in adoption of cloud computing.  |
| [17]        | The Organizational Critical Success Factors for Adopting Cloud Computing in SMEs  | Organizational factors that have effect on cloud adoption in SMEs   | Lower level of awareness of the benefits of cloud computing among small businesses has been identified. In addition, SMEs lack financial resources.   |

## 5. Challenges of Cloud Computing Adoption in It-Organizations

Despite the benefits of cloud computing adoption in IT-organizations discussed above, there are also some challenges that serve as a barrier to effective implementation of cloud computing services in some IT-organizations [33]. Generally, these challenges are categorized into technology, usability and cultural challenges [42, 43]. More specific challenges may be privacy, interoperability, reliability[44], service availability, on demand service deployment may cost more, and portability[33]. The following section discuss the research background and related work

## 6. Research Background and Related Work

In table 1, research background and existing related work with findings were discussed accordingly. Since the above-mentioned studies are not comprehensive enough therefore we initiated to explore more about this topic. In order to carry out our research, we have designed our research methodology as described in the next section.

## 7. Research Methodology

This section provides discussion on the methodology we applied to carry out this systematic literature review, ranging from the review plan to the documentation as shown in Figure 4.

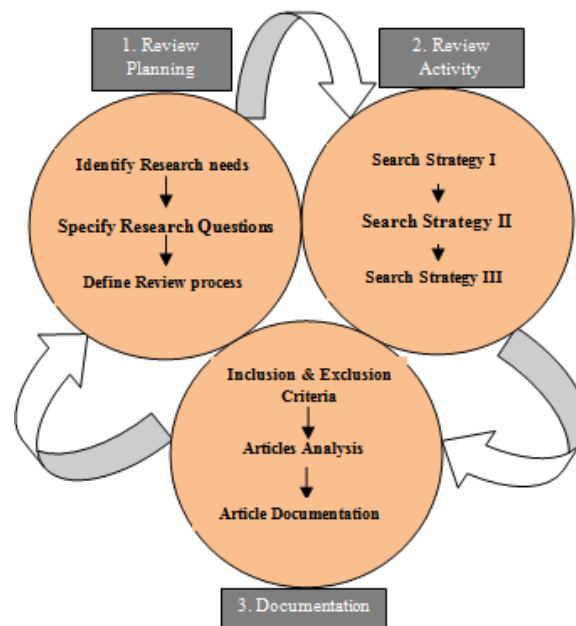


Figure 4. Research strategy overview

In contrast to a non-structured review process, a systematic literature review reduces bias and follows a precise and rigorous sequence of methodological steps to search literature. For this SLR, we adopted the guidelines by[49] with a three-step review process that includes review planning, review activity and documentation.

### 7.1 Review Planning

This activity was the first in the series of activities under research methodology in our SLR, which contains other sub activities as follows:

**Identifying Research Needs.** The need for this systematic literature review identified and discussed in section 1.

**Research Questions.** We defined two (2) research questions as shown in Table 2. These research questions provided us an evidence-based overview of cloud services adoptions. The motivation column in Table 2 outlines the primary objective of investigation for each question.

**Table 2. Research questions and their motivation**

| Research Questions   | Motivation   |
|--|--|
| RQ1 - What are the factors that drive adoption of cloud computing services in IT organizations?                  | The aim of this RQ is to identify existing factors that motivate cloud adoption.   |
| RQ2 - What are the risks /challenges faced by IT organizations before, during and after adopting cloud services? | The aim of this RQ is to identify the existing risks and challenges faced by IT organizations before, during and after cloud adoption. |

**Define review process.** This sub activity provides the procedure designed for this SLR as discussed in section 7

### 7.2 Review Activity

In this second phase of systematic literature review, study selection process was designed that includes search strategy I, search strategy II and search strategy III.

**Search Strategy I.** In first search strategy, approximately 100 keywords related to the research domain like: "Cloud", "cloud Computing", "Cloud Services", "Cloud adoption", "Cloud performance" etc. were used in order to gather primary information from more popular journals and conferences. We also used AND and OR operators to create combination of search strings as shown below.

|   |
|---|
| <p><i>Cloud [AND]</i></p> <p><i>"Computing" &lt;OR&gt; "Services" &lt;OR&gt; "Adoption" &lt;OR&gt; "performance" &lt;OR&gt; "Migration"</i></p> <p><i>&lt;OR&gt; "Computing services"</i></p> <p><i>[AND]</i></p> <p><i>Systematic Literature Review &lt;OR&gt; Systematic Review &lt;OR&gt; SLR &lt;OR&gt; Systematic Mapping</i></p> <p><i>&lt;OR&gt; Literature Survey &lt;OR&gt; Research Review &lt;OR&gt; Research Synthesis &lt;OR&gt;</i></p> <p><i>Research Synthesis &lt;OR&gt; Secondary Study</i></p> |
|---|



**Search Strategy II.** In second search strategy, 65 keywords that are more related to the domain were selected like: "IT-organizations using Cloud", "Cloud adoption on IT-Organizations", "Cloud performance on IT-Organizations etc. This provides more related information.

**Search Strategy III.** In the third and the last strategy, primary materials were classified according to paper type [Journal or Conference], Year of the publication, acronyms of the paper type, number of journals, number of conference papers and finally the total number of papers per year as shown in table 3.

### 7.3 Documentation

This is the third and the last phase of this systematic literature review. It provides inclusion and exclusion criteria and detailed analysis.

Table 2 presents the study sources in terms of journal articles included and those excluded from this SLR.

**Table 3. Inclusion and exclusion criteria**

| Inclusion Criteria  | Exclusion Criteria   |
|---|--|
| Peer-reviewed papers concerning cloud computing, including research survey and case study.  | Papers concerning cloud computing, cloud adoption and organizational performance using cloud those are not peer-reviewed, even though it met the inclusion criteria. |
| Peer-reviewed papers concerning cloud adoption.   | Literatures concerning cloud adoption, cloud performance and organizational performance published before the year 2010.  |
| Peer-reviewed papers concerning cloud adoption and organizational performance.  | Papers or research reports that discusses information out of the academic scope.<br>Cloud computing business reports.  |
| Literatures concerning cloud adoption, cloud performance and, organizational performance published between the year 2010 and 2015 |  |

The inclusion and exclusion criteria as stated by [29] were followed. The guidelines for systematic literature review as outlined by [49] were also followed in extracting the required information for this SLR paper. Endnote was used for managing the Citation and Bibliography as well as all the extracted articles used in this paper.

**Collection Criteria and Analysis.** Primary materials were searched using the strategy outlined by review activity in section 7 and the required information was gathered from various and popular journals and conference proceedings available in various digital libraries. The sources were analyzed and are presented in table 4 below.

**Table 4. Collection Criteria and Analysis**

| Collection Sources 2015              |  |               |
|--------------------------------------|--|---------------|
| Journal=12, Conference= 1, Total= 13 |  |               |
| Paper type                           | Title Source   | ISSN/Acronyms |
| Journal                              | A survey study on major technical barriers affecting the decision to adopt cloud services  | 0164-1212     |
| Journal                              | Rethinking the role of security in client satisfaction with Software-as-a-Service (SaaS) providers   | 0167-9236     |
| Conference                           | Understanding Software-as-a-Service (SaaS) Commitment from a Client-Provider Collaboration Approach  | PACIS'2015    |
| Journal                              | Organizational sustainability modeling—An emerging service and analytics model for evaluating Cloud Computing adoption with two case studies | 0268-4012     |
| Journal                              | CloudLive: a life cycle framework for cloud services   | 1019-6781     |
| Journal                              | Cloud Adoption in Malaysia: Trends, Opportunities, and Challenges  | 2325-6095     |
| Journal                              | Understanding determinants of cloud computing adoption using an integrated TAM-TOE model   | 1741-0398     |
| Journal                              | Quality of service approaches in cloud computing: A systematic mapping study   | 0164-1212     |
| Journal                              | A Super Base Station based Centralized Network Architecture for 5G Mobile Communication Systems  | 2352-8648     |
| Journal                              | Innovations in Data Collection, Management, and Archiving for Systematic Reviews   | 0003-4819     |
| Journal                              | Effects of security and privacy concerns on educational use of cloud services  | 0747-5632     |
| Journal                              | A Decision Model for the Evaluation and Selection of Cloud Computing Services: A First Step Towards a More Sustainable Perspective           | 0219-6220     |
| Journal                              | A Brief History of Cloud Offload: A Personal Journey from Odyssey Through Cyber Foraging to Cloudlets  | 1559-1662     |

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Journal= 14, Conference= 1, Total= 15

| Paper type | Title Source   | ISSN/Acronyms   |
|------------|--|-----------------|
| Journal    | Issues in the Study of Organizational Resilience in Cloud Computing Environments   | 2212-0173       |
| Journal    | An exploratory study to understand the critical factors affecting the decision to adopt cloud computing in Taiwan hospital | 0268-4012       |
| Journal    | A structural equation modeling approach for the adoption of cloud computing to enhance the Malaysian healthcare sector     | 0148-5598       |
| Journal    | Cloud Computing: Adoption Issues for Sub-Saharan Africa SMEs   | 1681-4835       |
| Journal    | Factors Influencing the Adoption of Cloud Computing by Small and Medium Enterprises (SMEs) in Developing Economies         | 9781303912801   |
| Journal    | Factors influencing electronic commerce adoption in developing countries: the case of Tanzania                             | 2078-5585       |
| Journal    | Virtual Cloud Security by Using Hypervisor-Based Technology  | 2001-5569       |
| Journal    | State-of-the-art Survey on Cloud Computing Security Challenges, Approaches and Solutions                                   | 1877-0509       |
| Journal    | Secrecy Protection and Data Security Matters in Cloud Computing  | 2005-4238       |
| Journal    | The Role of Top Manager Behaviors on Adoption of Cloud Computing for Small and Medium Enterprises                          | 1991-8178       |
| Journal    | Impacts on the Organizational Adoption of Cloud Computing: A Reconceptualization of Influencing Factors                    | 2212-0173       |
| Conference | Data Security Issues in Cloud Environment and Solutions  | WCCCT '14       |
| Journal    | Cloud computing service composition: A systematic literature review  | 0957-4174       |
| Conference | Analysis of the Impact of Cloud Computing Technology to E-government Performance Evaluation                                | MobileCloud '14 |
| Journal    | Advantages and Challenges of Adopting Cloud Computing from an Enterprise Perspective                                       | 2212-0173       |

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| Journal= 8, Conference= 2, Total= 10 |  |               |
|--------------------------------------|--|---------------|
| Paper type                           | Title Source   | ISSN/Acronyms |
| Journal                              | User centric cloud service model in public sectors: Policy implications of cloud services  | 0740-624X     |
| Journal                              | Enhanced cloud based model for healthcare delivery organizations in developing countries   | 1089-7801     |
| Journal                              | Cloud computing and trans-border health data: Unpacking US and EU healthcare regulation and compliance   | 2211-8837     |
| Journal                              | Privacy and security issues in cloud computing: The role of institutions and institutional evolution   | 0308-5961     |
| Journal                              | The organizational critical success factors for adopting cloud computing in SMEs   | 2289-1358     |
| Journal                              | Key challenges in cloud computing: Enabling the future internet of services  | 1089-7801     |
| Journal                              | Observations of achievement and motivation in using cloud computing driven CAD: Comparison of college students with high school and vocational high school backgrounds | 0747-5632     |
| Conference                           | Factors That Affect The Adoption Of Cloud Computing For An Enterprise: A Case Study Of Cloud Adoption Within Intel Corporation   | ECIS '13      |
| Journal                              | Enhancing the product realization process with cloud-based design and manufacturing systems  | 1530-9827     |
| Conference                           | Distributed collaborative design and manufacture in the cloud—motivation, infrastructure, and education  | AC2012-3017   |
| Collection Sources 2012              |  |               |
| Journal= 5, Conference= 2, Total= 6  |  |               |
| Paper type                           | Title Source   | ISSN/Acronyms |
| Conference                           | Exploring the impact of Cloud Computing adoption on organizational flexibility: A client perspective   | ICCCTAM '12   |
| Journal                              | Factors that determine the adoption of cloud computing: A global perspective   | 1466617624    |

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|            |   |           |
|------------|---|-----------|
| Journal    | Cloud computing evaluation based on financial metrics                 | 2255-9094 |
| Journal    | Success factors for deploying cloud computing                         | 0001-0782 |
| Journal    | Cloud computing as an innovation: Perception, attitude, and adoption  | 0268-4012 |
| Conference | How Do Cloud Capabilities Impact Various Aspects of IT Effectiveness? | CLOUD '12 |
| Journal    | Addressing cloud computing security issues                            | 0167-739X |

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## Collection Sources 2011

Journal= 6, Conference= 0, Total= 6

| Paper type | Title Source  | ISSN/Acronyms |
|------------|---|---------------|
| Journal    | Cloud adoption: a goal-oriented requirements engineering approach   | 1450305822    |
| Journal    | Performance analysis of cloud computing services for many-tasks scientific computing  | 1045-9219     |
| Journal    | Cloud computing services: taxonomy and comparison   | 1867-4828     |
| Journal    | Identification of a company's suitability for the adoption of cloud computing and modeling its corresponding Return on Investment | 0895-7177     |
| Journal    | A survey on security issues in service delivery models of cloud computing   | 1084-8045     |
| Journal    | Challenges and benefits for adopting the paradigm of cloud computing  | 2230-7818     |

## Collection Sources 2010

Journal= 4, Conference= 1, Total= 5

| Paper type | Title Source  | ISSN/Acronyms |
|------------|---|---------------|
| Journal    | A view of cloud computing                                       | 0001-0782     |
| Journal    | Cloud computing in developing economies                         | 0018-9162     |
| Conference | The impact of Cloud Computing and organizational sustainability | CCV '10       |
| Journal    | Cloud computing and developing nations                          | 0001-0782     |
| Journal    | Cloud computing: the new frontier of internet computing         | 1089-7801     |

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Figure 5 shows the percentage of the indexed journals and conference proceedings used in this review.

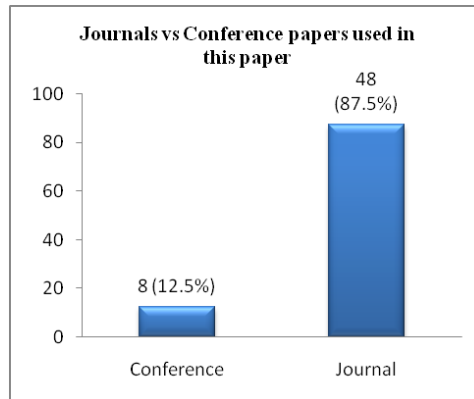


Figure 5. Indexed Journals vs. Conference proceeding Papers

Figure 5 shows the number of Journal articles and conference proceedings gathered for this review. The Figure 5 depicts that the number of Journal articles used were 48 (87.50%) and the conference proceedings were 8 (12.50%). There was high difference between the journal articles and conference papers used in this research because the number of journal articles on cloud computing services outweighs the number of conference proceedings in all the indexed journals searched.

Figure 6 shows analysis using the acronyms of popular indexed journals used in this paper, the papers used were more related to cloud adoption and cloud service performance.

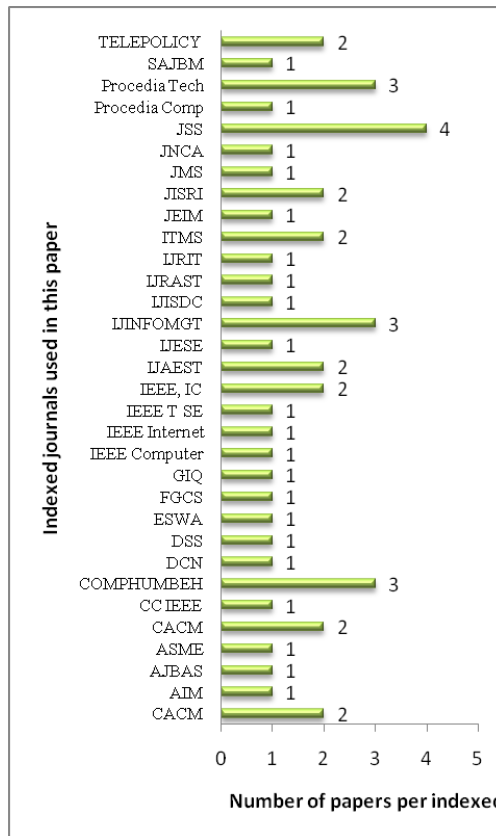
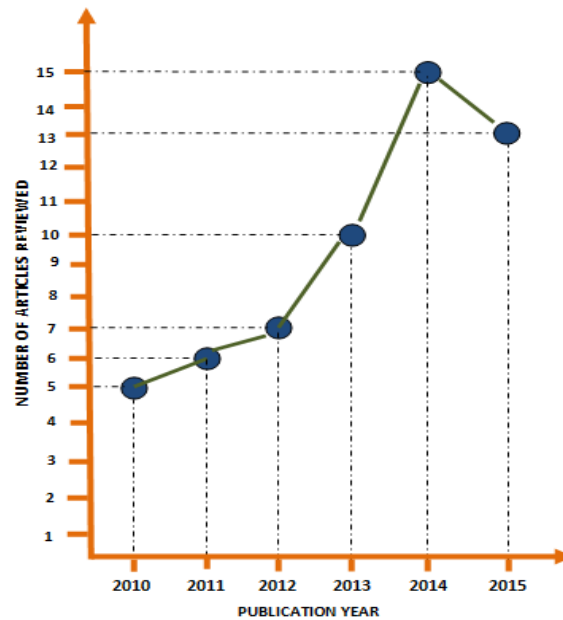


Figure 6. Indexed journals for cloud adoption

As shown in Figure 6 that Journal of Systems and Software (JSS) happened to be the highest contributing source with four (4) articles followed by Procedia Technology, Computer in Human Behavior (COMHUMBEH) and International Journal of Information Management (IJINFOMGT) with three (3) articles each. Communications of the ACM (CACM), IEEE Transaction on Software Engineering and the like, provided two (2) study sources each. However, the remaining contribution sources provided one (1) study material each.

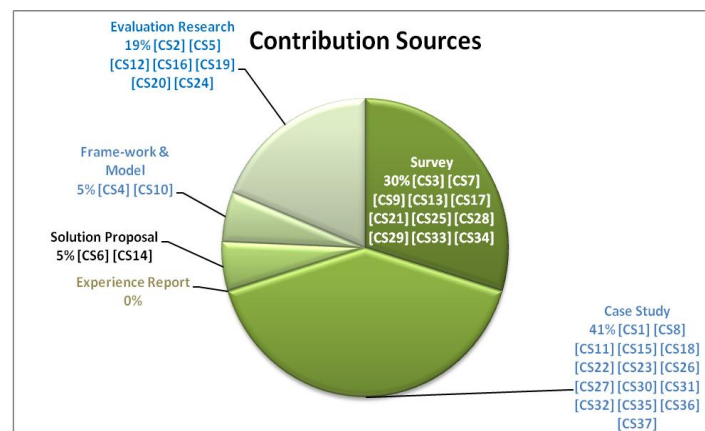
Figure 7 presents the publication trends in cloud since 2010 to 2015.



**Figure 7. Publication trends in cloud**

The articles published in 2014 provided the highest contribution with fifteen (15) papers, followed by 2015 with thirteen (13) study materials. However, papers used in this review published in 2013 were ten (10); while those published in 2011 were six (6) papers. Year 2010 contributed five (5) papers only.

Figure 8 shows the analysis of the categories of sources used in this research referred as contribution source [CS].



**Figure 8. Contribution Sources**

The largest set of contribution sources [CS] used in this review was case study related (41%), followed by Survey related papers (30%). However, 19% of the total number of papers was related to evaluation research. Similarly, 5% of the total number of papers was related to frame-work & models and another 5% were related to the solution proposal. On the other hand, our observation indicates the lack of experience reports in the contribution sources. Next section provides brief description on how the research questions were solved.

**RQ1.** Covers major factors that lead to cloud adoption includes, ability to seamlessly move existing application to cloud and back onsite if needed [15, 43], organizational agility and scalability [50], compete with other business organizations [34, 51], operational cost reduction [52] and New or improved disaster recovery capacity.

**RQ2.** Covers major risks /challenges faced by IT organizations before, during and after cloud adoption are as follows:

*Before Adoption.* Data Control and Backup Solutions, Difficult in service delivery to customers[30, 53], Lack of new competition strategy, Less organizational flexibility, Long development life cycle and High Bandwidth Cost[54, 55]

*During adoption.* Assess the cloud providers' commitment to provide uninterrupted service[56], Choose the right workloads to start in the cloud[57], Performance, availability, security, scalability [PASS] testing methodologies with detailed procedures and test cases[58].

*After adoption.* Automatic updates enforce changes, Businesses juggled too many cloud apps, Cost-saving benefits disappear as demand grows, Interoperability and Portability, Lack of internet access leaves data out of reach and Lock-in with CSPs proprietary application programming interfaces (APIs) Compliance requirements[20, 59]. Next section presents factors determining the adoption performance of cloud computing services.

## **8. Factors Determining the Adoption Performance of Cloud Computing Services**

Researchers in the field of cloud computing made tremendous efforts to figure out the factors determining the adoption performance of cloud computing services, according to [55], the factors are: Improved Security, Trustworthiness, Reliability, Effectiveness, Efficiency, and Improved Quality of Service[60]. Stated the factors as: Improved Information access, Improved Quality of decision making, Improved Competitiveness, Improved service delivery, Improved staff satisfaction, Improved service availability. [61] Better customer satisfaction, Scalability, Speed, Improved productivity and Reduction of staff cost. [32] Operational cost reduction and new business or market strategy. Improved Return On Investment [ROI]. Improve Job creation [62].

### **8.1 Classification of Factors Determining the Adoption Performance of Cloud Computing Services**

The paper classify the factors determining the performance of cloud computing services into Organizational based, Customer based, Financial based, Staff based and cloud infrastructure/services based factors as shown in figure 9 below.





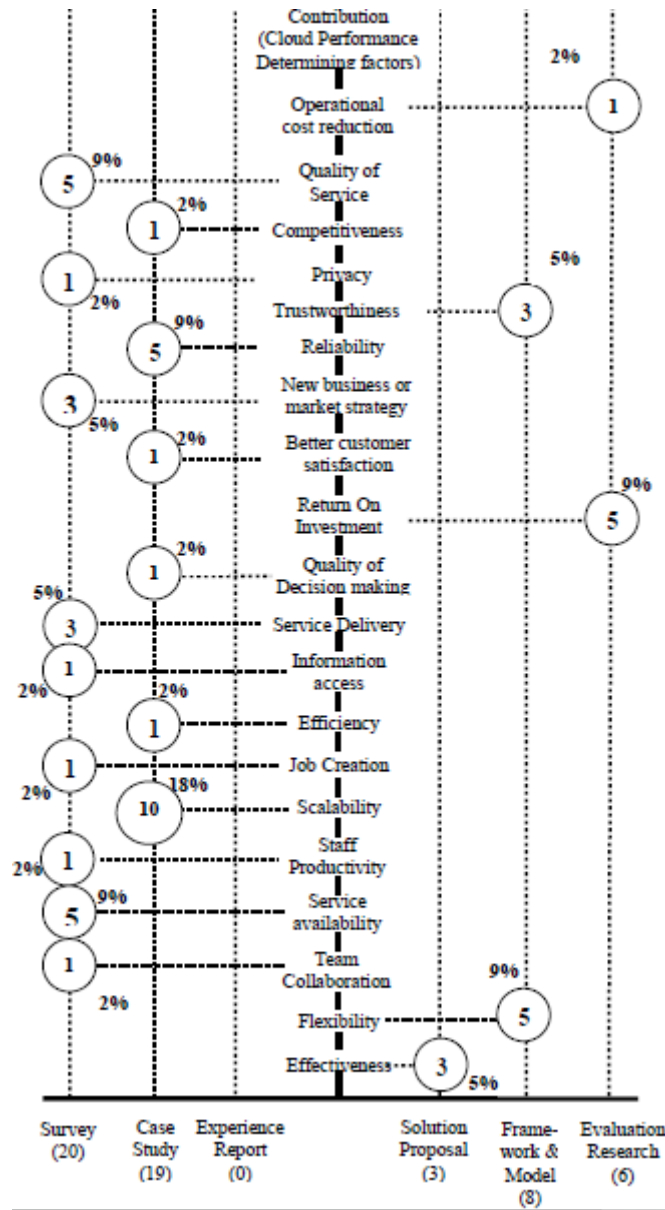


Figure 10. Cloud performance determining factors according to number of contributing sources

We systematically identified the factors based on the contributing articles and contribution type. Figure 10 provides a systematic overview of current research, focusing on proposed methods, techniques and solutions in the cloud adoption strategy. The figure shows that majority 10 (16%) of the sources are scalability related. Followed by Quality of service, Reliability, Return of Investment, Service availability and flexibility related with 5 (7%) each. However, sources related to new business or market strategy, trustworthiness, service delivery and effectiveness were 3 (5%). Similarly, the remaining sources were 1(3%) each. The figure also shows 20 case study related papers, survey related papers were 19. However, 6 out of the total number of papers used were related to evaluation research. Similarly, 8 out of the total number of papers were related to Frame-work & Models and another 3 papers was related to solution proposal. On the other hand, the figure also indicates lack of experience report in the contribution sources. Following steps of searching, evaluation and alternate reviews, 56 articles were finally selected from the 217 articles found from the first search. We believe the selected 56 articles could cover the basic view of the studied area of cloud computing.

## 9. Conclusions and Future Research

The goal of conducting this systematic literature review was to provide an overview on the state-of-the-art of cloud computing services adoption and to explore the cloud performance determining factors. To this end, 56 articles including 48 journal articles published in various indexed journals and 8 conference proceedings also published in various indexed journals from 2010 to 2015 were identified as primary studies. The majority of these articles were published in indexed journals followed by the few conference proceedings also published in indexed journals. Cloud computing technology provides attractive benefits to many public and private organizations. These organizations believed that cloud computing has the potential to reduce operational cost by abstracting capital assets like data storage center and processing systems into a readily and on demand available also at affordable operating expense. Barriers affecting cloud adoption differ significantly from one country to another, but generally the adoption depends on the country's level of business and economical development issues like lack of effective awareness, reliable power and broadband connectivity has been identified as major barriers to effective cloud utilization. We systematically identified the factors based on the contribution sources and contribution type. This provides a systematic overview of current research, focusing on proposed methods, techniques and solutions in the cloud adoption strategy. After the steps of searching, evaluation and alternate reviews, 56 articles were finally selected from the 217 articles found from the first search. We believe the selected 56 articles could cover the basic view of the studied area of cloud computing adoption. In future research, Area of cloud computing is very wide; we hope this opens an opportunity for further research to compare the performance level of these identified cloud performance indicating factors.

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