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Cloud Computing adoption in the financial banking sector-A systematic litreture review (2011-2021)

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ABSTRACT

Scholarly research works on the adoption of Cloud Computing (CC) have recently emerged with the technology's importance for organizations at a fast pace. Despite the numerous advantages of CC adoption for financial institutions (FI) in terms of storage cost mitigation, computation higher increase, and information access higher access rates from any place, Banking's CC adoption executives and practitioners are badly seeking to obtain trustworthy recipes of how to utilize CC adoption frameworks to transform banks operations to cloud. In this vein and based on a systematic literature review (SLR) method, we conducted a review of 370 empirical studies from 2011 to 2021, downsized the studies to 27 directly relevant papers to reveal 14 frameworks, methods, models, or strategies of CC adoption in Banking sectors in 14 countries, and compared the findings across studies in terms of the utilized frameworks, methods, models, or strategies.

1. Introduction

According to [1], Cloud Computing (CC) is "a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction".

Cloud Computing (CC) has motivated a new horizon for many economic sectors worldwide throughout the provision of on-demand computing services along with a higher performance, costs services reduction, ubiquitous access, flexibility, scalability, and availability [2,3]. Therefore, adoption of CC is demanding nowadays [4].

Since 2010, scholars studied the CC adoption in many industries, however, the financial institutions (FI), particularly the banking sector is lacking these initiatives even though for the FIs, CC adoption is prescribed as a highly important IT innovation technology.

Apparently, there exists several adoption models, methods, strategies, or frameworks, however most studies don't provide holistic frameworks towards CCA for FI. Also, most proposed solutions are not evaluated and tested in reality. Moreover, some studies consider specific concerns such as, security of the cloud, importance of CC, and many other areas of CC, but the CC adoption. There are other cases that view the enterprise from different aspect not from EA view or use other frameworks

development tools which give different results, other than that there is some comparison between traditional process with advance technology in banking without measuring the effort of the suggested/ proposed framework. Finally, most of these studies are utilized outside of the GCC region.

A comparative analysis to current studies is necessarily required to demonstrate the similarities and the differences. Noticeably, the research works are categorized based on their geographical location employment and the frameworks, methods, models, or strategies applied in the CC adoption. For example, five studies were found in the middle east region and Africa (MENA), such as Egypt, Iran, Ethiopia, and Kenya, while seven studies were found in Asia including four in India and one in Malaysia. Two studies were found in Europe, one of which is in Romania, while one study was found in USA and Nepal respectively.

2. Literature Review

A. The SLR profiling methodology

This section details on the analysis method to investigate the current state-of-the-art of the study objectives, using systemic literature review (SLR) method. Starting with main study question, the first step will be identifying the main key words for the search, then begin searching in primary data sources using these keywords which shown in Table 1.

The next step is to analyse and redefine the search equerry, by adding multiple word using (AND-OR) formula, this gives more accurate result. After the searching process, the result will be refining again after skim read; this complex process will be applied to secondary data sources also, to assure selecting high quality journals and eliminating others which are not relevant to the study. References are mostly Scopus and/or with high impact factor.

Table 1. Searching Keywords

Cloud Computing	Literature review	Financial Enterprise
Cloud computing	Framework	Bank
CC/Cloud	Method	Retail bank
CC adoption	Model	Financial institution

Completing these steps extract most relevant related work as demonstrated in Table 2 at which we started with 370 empirical studies and ended up with 27.

Table 2. Findings of The Profiling Methodology

P1: Searching of data sources	J.article + Conf paper+Dissertations					
P2: Applying searching formula	-	-	-	-	OR	370
P3: Refining the document items	-	-	-	-	AND	105
P4: Manual reviewing and exclusion		35				35
P5: Selection & review of studies		27				27

B. Cloud Computing (CC)

CC is defined by as the use of resource pool on demand or on spot with high scalable infrastructure resources, taking the advantage of computing power with no need to predict actual need at which the estimation need, and cost will not be considered [5].

1) Cloud Computing models

[5] represent the three main service models of CC including, software as a service (SaaS) which provides services the end users such as Microsoft office- oracle- drop box, platform as a service (PaaS) which supports the Application developer example operating system- azure- SQL, and infrastructure as a service (IaaS) which supports infrastructure and network architecture such as

AWS- cisco metacloud. The deployment model consists of four types: public cloud, private cloud, hybrid cloud, community cloud. Choosing between different CC model and service depends on several external factor or internal factor, or both. Several reasons include the institution characteristic, the required development, current IT infrastructure, and the budget of development [5].

2) Cloud Computing characteristics

Speaking about the characteristics of CC, it was evident that utilizing CC mitigates extra cost and focuses on business strategy without considering the ICT. Also, CC gives advantage of anywhere access meaning that IT support team is not completely needed because team member's salaries would consume most of the organizational budget. Furthermore, CC can solve problems related to operating systems at which infrastructure handling depends on the chosen cloud infrastructure. On the other hand, CC still has bad reputation in terms of security and reliability [6].

3) Cloud Computing adoption

CC characteristics and advantages sparked the interest of CC adoption for the organizations in variant field, statics show high growing in CC adoption in multiple regions [7], however, [5] mentioned that CC adoption rate is not rising as fast as expected due to some reasons. [8] believe that any transition plan needs proper strategic plan to handle errors and ensures proper migration to the new developed framework. In achieving its objectives, [9] believe that CC adoption plan requires 5 to 15 years. The size of the enterprise plays a big role in terms of CC adoption for example micro or small enterprises have limited resources and tight budget, therefore are not favoured CC adopted.

C. The Financial Institutions (FI)

According to [10], the term FI has ambiguous definitions. A standard one of which is that FI refers to all legal entities providing financial services on market such as businesses that provide financial services as intermediaries in monetary, deposits, currency exchange, investment, and loan.

1) Types of FIs

FIs are categorized as either non-profit institutions such as charitable societies, and charities, or pro-profit institutions such as banks, and insurance companies. According to [11], there are massive range of financial institutions/enterprises which are categorized into four including, banks, insurance companies, pension schemes, foundations and endowments. However, [12] detail on another eight financial institutions such as financial service corporations, savings and loan associations (S&LS), mutual saving bank, credit union, pension funds, life insurance companies, mutual funds, and hedge funds.

2) The banking sectors

One of the most commonly known sectors in FI is banking. Banking has the largest segment comparing to other FI sectors. Summarized in Table 3, [13] outlines the range of bank types including, commercial, investment, saving, CBB, industrial, real estate banks, agricultural, Islamic, retail. All around the world, there are similar set of factors between these types, but the fundamental differences depend on firm size, total and fixed assets, market-to-book ratio, and profitability.

Table 3. Several Bank Types and Characteristics

Bank type	Bank Characteristics
Commercial	Offer deposit and loans services for public and private.
Investment	Provide financial services that deal with fund advisory in business or corporations that seeking for profit.
Saving	Accept saving deposit to pay interest for these deposit.

CBB	Manage the country currency, central monetary authority, and deal with gov. or other banks.
Industrial	Provide investment certificates for public and private sector from investing and fund seeking.
Real estate	Provide finance for residential property, commercial property, and lands.
Agricultural	Lend money for long period with less interest for supporting small enterprises
Retail	Provide services to public rather than private.
Islamic	Provide financial services compatible with islamic laws.

D. CC Adoption in banking

Throughout the reviewing of literature, it was evident that every enterprise has a unique framework to control the flow of tasks. However, currently, the current frameworks development appears mismatching the frequency rate of innovation. The paradigm shift is the adoption of CC. An evident gap exists between the academic CC adoption initiatives and the industrial/commercial CC adoption utilizations.

Also, the decision of adaption in financial enterprise which handles sensitive data has many restriction and bureaucracy as advocated by [13] due to its value. [5] argue among adoption consideration in term of benefit and risk for SME. Several internal and external factors of the enterprises mitigate the CC adoption, including, firm size, environment, and regulations [12].

The transformation of the banks into cloud computing has eight advantages. This includes optimized environments, overcoming challenges, high speed bandwidth, multichannel integration, new offerings, high revenue gain, low cost of data centers, flexible platforms for advanced banking services [14].

E. Previous work

Researchers has studied the effect of CC adoption in FI banking sectors and argued that CC adoption is highly important for banking in terms of CC technology benefit in this sector. Table 4 provides a comparative analysis of currently available studies to demonstrate the similarities and the differences. Noticeably, the research works are categorized based on their geographical location employment and the frameworks, methods, models, or strategies applied in the CC adoption. For example, five studies were found in the middle east region and Africa (MENA), such as Egypt, Iran, Ethiopia, and Kenya, while seven studies were found in Asia including four in India and one in Malaysia. Two studies were found in Europe, one of which is in Romania, while one study was found in USA.

Table 4. Frequencies of Currently Available Findings

Id	Authors	Source	Source_Name	Loc	Year
15	Awadallah, N.	J. article	IJCSI	Egypt	2016
16	Niazmand, N.	J. article	IJISSM	Iran	2016
17	Sisay, T.	PhD Diss.	-	Ethiop	2017
18	Yenew, M.	J. article	EJCSIT	Ethiop	2019
19	Milgo, D, et al.	J. article	EJCSIT	Kenya	2020
20	Introna, N.	PhD Diss.	-	S.Afr	2015
21	Asadi, S. , et al..	J. article	Info Tech &Mgt	Malay	2017
22	Sudr, K., Kumar, G.	J. article	IJCSIT	India	2014
23	Thabit, F., Alhdy, S.	J. article	IRJAET	India	2014
24	Sanapu, L, et al.	J. article	IJCAC	India	2018
25	Aruna, D. N.	J. article	EJMCM	India	2020
26	Frăţilă, L., Zota, R.	J. article	Procedia Eco& Fin	Roman	2013
27	Hon, W.,Millard, C.	J. article	Q Mary Sch.Law	EU	2016
28	Ramcn, M.,Cheng, V	C. paper	5Int. Con CC, Ser Sci.	USA	2015
29	Bajraha, A., Rour, R.	J. article	Lbef Res J sc,tec&Mgt	Nepal	2020

Moreover, while Figure 1 demonstrates the frequencies of publications, while Table 5 summarizes of the relevant research purposes (R_id 15 until 29) and contributions. Alternatively, Table 6 summarizes the purposes of the research studies along with the utilized frameworks, methods, models or strategies. Some research studies including (01,11, 13) lacked utilizations of frameworks, methods, models, or strategies applied in the CC adoption in the previous scholarly works.

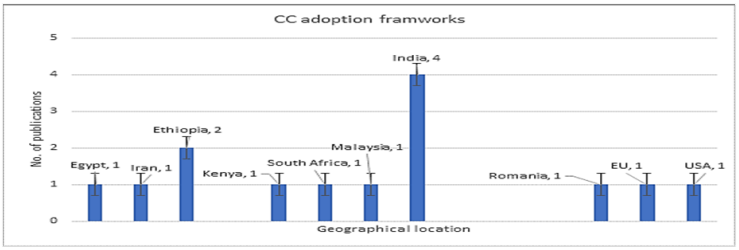

Figure 5. Publication frequencies and distribution

Table 5. Relevant Research Purposes

Id	Research purpose
15	This study explores the improvement of CC security by suggesting some rules and discussing the effect of cloud security in financial enterprise adoption, considering several CC adoption facts.
16	This study compares between the current structure/resources of a bank industry and the impact of on promise CC technology in terms of reducing cost and reducing energy consumption.
17	This study proposed to design an interoperable CC framework that serves the banking community and enables to perform banking transaction and to minimize the technological costs
18	This case study is applied in Dashen bank, by designing a CC architecture that focuses in reducing the need of labour to manage the IT while enhancing the uses of technology.
19	The study develops an enhanced cloud adoption FW that guides CC adoption in the FI sector and tests its performance.
20	This study examines ways in which S. African financial service providers are able to increase the rate of CC adoption, by developing a FW for medium-sized orgs to assess the feasibility.
21	This study considers the financial enterprise bank sector adoption by considering the adoption strategy in customer perspective.
22	This study views benefit of CC adoption in business model of financial enterprise bank sector.
23	This study discusses the bank new products development, the featuring of adaptation in technological infrastructure and the changes made to achieve CC strategic positioning.
24	This study proposes a FW for Indian banking sector having strong regulatory FW based on diffusion theory for CC adoption.
25	This study compares between the traditional banking processes and the advanced technology of CC for banking industry. Results include advantages of cloud computing micro banking.
26	This study analysis the Romanian Internet banking market and compare some of the most popular Internet banking platforms. The result represents SaaS as a type of cloud computing services that suit bank deployment.
27	This study summarizes how CC adopting in banking is restricted to regulators and how cloud providers affect the CC adoption.
28	This study provides an improved CC Adoption Framework V1.1 (CCAF 1.1), which emphasizes on the security policies, recommendations, techniques, and technologies to be updated.
29	This study investigates the adoption of CC in banking segment & to find out the major challenges and opportunities in Nepal.

Alternatively, Table 6 summarizes the purposes of the research studies along with the utilized frameworks, methods, models or strategies. Some research studies including (01,11, 13) lacked utilizations of frameworks, methods, models, or strategies applied in the CC adoption in the previous scholarly works.

Table 6. Utilized FWS, Methods, Models, Strategies

R. Id	Model	Description
16	Static Comparison	A Comparison method between on promise cloud computing vs on resources in term of reducing cost reducing power consumption.
17	Community deployment model & SaaS	A process that involves deploying an application through a platform or infrastructure or software as a service, these studies suggested SaaS as best of other deployment model.
18	CC architecture	A design architecture that focuses in reducing the need of labour to manage the IT infrastructure while enhancing the uses of technology.
19	Explanatory and case study research des.	A research design that guides for CCA testing in the cloud environment to measure the performance base on suggested framework.
20	Technology organisation environment	A theoretical model that is utilized to understand the role of technology, org, and environment which affect technology implementation decisions.
21	TAM-diffusion theory model (TAM-DTM)	A theory that explains how technology users come to accept and use it stating that behavioral intention is the main factor that influences people's use of technology.
22	Cloud service model	This research views the benefit of CCA in business model of FI in bank sector.
23	Cloud deployment model	A process that involves deploying an application through a platform or infrastructure as a service which suggest SaaS as best deployment model.
24	Diffusion theory	Diffusion of ideas explains how they can be spread among various groups.
26	Cloud service model	This research views the benefit of CCA in business model of FI in banking sector.
28	Fine Grained Security Model	A Fine-Grained Security Model is CCAF which focuses on security.

3. Conclusion

This study employed a systematic literature review to identify, overview, explore, and summarize the current state of CC adoption in banking sector as a subset of FI industry. An overview of factors supported by 27 empirical studies as well as an overview of empirical research on this topic have been provided. Starting with CC information technology, the cloud facts such as: type, model, characteristic, advantages, and disadvantages has been debated. next was explanation of FI, passing through standard definition and different types, moreover, display the importance of this field. gradual from FI to banks sector, then overly types of bank, this present the reason of choosing FI over other sectors. Finally, a comparative study is applied globally, this state current FI CC adoption which requires a methodology, method, model, or strategy to develop. Our study contributes to the research by exploring adoption models for cloud computing in banks that is built on existing theories and examined empirical evidence. Moreover, the study identified a gap in the literature in that there is a lack of research on the availability of practical frameworks for cloud computing adoption As practical implications, the current study provides a blueprint for local and international banks deciding to adopt cloud computing. However, this study is expected to be extended with a follow-up of literature to update and compare the results with the most recent empirical findings in the forthcoming years onward.

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