

Cloud computing technology adoption challenges and solutions in Pakistan

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Abstract

Purpose: The idea of insurance was discovered several millennia before Christ (BC). In the second and third millennia BC, traders from China and Babylonia practiced shifting or dispersing risks. Today, insurance is the foundation of the economy, but expanding its penetration is difficult in emerging nations. The fourth insurance industry revolution in the developed world was sparked by the recent advent of Blockchain, IoT, Big Data, and InsurTech.

Objective: To boost insurance coverage in Pakistan, this study examines the problems with and potential solutions to cloud computing.

Research Methodology: To identify the themes and factors related to problems and solutions in implementing cloud computing in the Pakistan insurance business, this study used a systematic literature review. Several keywords were employed to find pertinent material from Google Scholar. The filtered studies were examined based on inclusion and exclusion standards.

Findings: This report outlined many obstacles to cloud-computing adoption in the Pakistan insurance sector as well as potential remedies. The proposals could help policymakers improve the service delivery in the insurance industry.

Introduction

Cloud computing is a popular computing model that offers a quick and affordable way to access IT infrastructure as an internet service. It has become a scalable services consumption and delivery platform, allowing for resource sharing among cloud service consumers, partners, and vendors. Cloud computing architecture varies among different projects, such as Google, force.com, and Amazon, but there is no concrete definition for cloud computing. The evolution of cloud computing has enabled the processing of large volumes of data and the adoption of pay-for-use models. However, cloud security remains a critical factor hindering its development, and further research is needed to enhance fundamental theories and explore innovative strategies (Umar et al., 2016).

Cloud computing has gained attention in Pakistan, particularly in educational settings, due to its cost efficiency and the desire of college students to adapt to emerging technologies. The use of cloud computing in educational establishments in Pakistan has been explored through surveys conducted in cities such as Peshawar and Faisalabad. The surveys aimed to understand the perception of users and identify potential issues faced when using cloud computing. Developing countries, including Pakistan, have recognized the benefits of cloud computing, such as reduced costs, scalability, and higher availability, in areas like e-governance, e-business, e-health, and e-education. However, challenges exist in implementing cloud computing infrastructure in developing countries despite the demand for cloud-based solutions. Overall, cloud computing is seen as a valuable technology in Pakistan, with the potential for future growth in various sectors (Greengard, 2010). Cloud computing adoption in the insurance industry in Pakistan is still unexplored, but it has gained popularity in the country.

Literature Review

Computing is the most emerging trend in Information Technology nowadays. It is attracting organizations due to its advantages of scalability, throughput, easy and cheap access, and on-demand up and downgrading of SaaS, PaaS and IaaS. Cloud computing challenges in Pakistan's insurance industry include security issues such as trust, confidentiality, authenticity, encryption, key management, and resource sharing. Pakistan faces security problems in implementing cyber services due to limited resources, technical personnel, and a lack of standardized policies. The country also lacks good-quality IT professionals and has an unstable political environment, discouraging investment in IT infrastructure. Data security, availability, integrity, information confidentiality, and network security are major challenges in cloud security. To address these challenges, data encryption, authentication, classification, and application programming interfaces (API) are recommended as security solutions. These measures can help ensure secure communication and protect sensitive data stored and retrieved from the cloud (Bansal et al., 2021).

The author took out the following data from the involved papers: author name, year of publication, country of publication, publication type, and findings. Consequently, a narrative synthesis of the derived information was attained. Table 1 denotes the literature included, such as articles, conferences, or books, methodology, and year. Table 2 denotes the challenges along with solutions derived after reviewing the selected studies.

Table 1 Characteristics of reviewed cloud computing adoption studies in Pakistan's insurance sector

No.	Journal name/ Conference Name	Paper topic/ Conference paper Name	Method	Year	Author
1	Annals of Telecommunications	An Empirical Study on acceptance of Secure Healthcare Service in Malaysia, Pakistan, and Saudi Arabia: A Mobile Cloud Computing Perspective	Quantitative	2017	(Amin et al., 2017)
2	IEEE International Conference on Cloud Computing and Intelligence Systems	Business intelligence in the cloud: A case of Pakistan	Qualitative	2011	(Khan et al., 2011)
3	Human Systems Management	Innovation-diffusion determinants of cloud-computing adoption by Pakistani SMEs		2017	(Zulfiqar et al., 2017)
4	Indian Journal of Science and Technology	Analyzing distributed denial of service attacks in cloud computing towards the Pakistan information technology industry		2020	(Memon et al., 2020)
5	Human Systems Management	Essential factors in cloud-computing adoption by SMEs		2017	(Zulfiqar et al., 2017)
6	International Journal of Advanced Computer Science and Applications	Medicloud: Hybrid Cloud Computing Framework to Optimize E-Health Activities		2017	(Hina et al., 2017)
7	A Thesis Presented to COMSATS Institute of Information Technology, Islamabad.	Implementation of Community Cloud Computing Infrastructure in Pakistani Healthcare Organizations		2014	(Imran, 2014)
8	International Journal of Computer Applications	A Comparative Analysis of Cloud Storage Pricing		2017	(Shahid et al., 2017)
9	International Journal of Engineering & Technology	Security of cloud computing: Belongings for the generations		2020	(Jahangir et al., 2020)
10	International Journal of Computer Science Issues	Cloud Computing: A General User's Perceptions and Security Issues at Universities of Faisalabad, Pakistan.		2012	(Haris et al., 2012)

11	SSRN	Antecedents of Adoption Intentions of Cloud Computing by Pakistani Companies		2020	(Hameed & Siddqui, 2020)
12	International Journal of Technical Research and Applications	Data security in cloud computing and svcost analysis: review		2013	(Rajeev, 2013)

Table 2 Cloud computing adoption in Pakistan Insurance Industry: Issues & Solutions

No. of Studies	Issues	Solutions
Study 1	<ul style="list-style-type: none"> • Tech-illiteracy • Time to learn new tech • Confidentiality • Need for funds • Interoperability problems • Lack of control over data governance owing to third-party processing, preventing compliance with privacy regulations and industry requirements • Data security • Isolation failure due to multi-tenancy in cloud when data shared with others 	<ul style="list-style-type: none"> • Nil
Study 2	<ul style="list-style-type: none"> • Nil 	<ul style="list-style-type: none"> • Establishing confidence in service providers' data privacy protection. • It should design rules, regulations and legislation to safeguard users' interests and assure cloud service providers' viability and consistency. • SLA (service level agreement) should include level of service, disaster recovery, security breach and data loss. • Service delivery, data security, privacy, and regulatory compliance should all be trained. • Government, relevant institutions, and growing authorities should instruct businesses on cloud computing, economic benefit, and online services.
Study 3	<ul style="list-style-type: none"> • Shortage of IT professionals as saas (ERP), iaas (Oracle's Elastic Cloud) and paas (SDK) demands well IT experts • Compatibility of technology with existing company working culture is a complex component of cloud computing. • CEO/Manager dissatisfaction, tension, and mental strain. 	<ul style="list-style-type: none"> • Nil
Study 4	<ul style="list-style-type: none"> • Data security 	<ul style="list-style-type: none"> • Pakistan currently lacks established regional guidelines for designing cyber-security plans.
Study 5	<ul style="list-style-type: none"> • Conformity to existing operational, cultural, and it infrastructure • Managerial support • Firm size • Dynamic complexity • It is in a nascent stage in Pakistan 	<ul style="list-style-type: none"> • Training packages may help ease cloud adoption.

	<ul style="list-style-type: none"> • Few research on South Asian underdeveloped nations like Pakistan 	
Study 6	<ul style="list-style-type: none"> • System compatibility • Comprehending the need for cloud and the ability to manage on-premises and off-premises assets to optimize client services. 	<ul style="list-style-type: none"> • There should be a cloud agreement for data security and authentication. • Cloud service providers must follow local laws. • Disaster recovery strategies should include data retrieval without loss. • System and software upgrades must be timely. • Standard models and interfaces facilitate cloud provider migration. • The deployment and service model should be chosen according to the need. Encryption and two-factor authentication help prevent illegal access.
Study 7	<ul style="list-style-type: none"> • Community cloud data security vulnerable to hackers • Technology unawareness, shortage of IT programmers 	<ul style="list-style-type: none"> • There should be a training or lecture programme for community cloud adoption in Pakistan, particularly in healthcare. • To make data available and secure.
Study 8	<ul style="list-style-type: none"> • Migration issues causing pricing increases 	<ul style="list-style-type: none"> • Users may utilize cloud storage for backup.
Study 9	<ul style="list-style-type: none"> • Web services located on cloud servers or relying on cloud computing may be hacked by hackers. • Denial of service attacks • Insecure programming of applications • Hacked interfaces, APIs, • Faulty authentications and credentials • Cloud computing lacks administration and control, causing security risks • Longer downtime and lower service provider dependability contribute to the security risk of interference. • Cloud computing technicians are seldom accessible. • This limits interoperability and portability. • Difficulty switching cloud service providers owing to lock-in periods. 	<ul style="list-style-type: none"> • To fulfill rising demand, cloud service providers need diverse tools and experience.
Study 10	<ul style="list-style-type: none"> • Time required to learn about the cloud computing concept • Lack of budget for cloud computing 	<ul style="list-style-type: none"> • Nil
Study 11	<ul style="list-style-type: none"> • Perceived cost benefits • Relative advantage • Top management support • Competitive pressure • Security & privacy • Reliability • Perceived concerns • Co-operation & Sharing 	<ul style="list-style-type: none"> • Nil
Study 12	<ul style="list-style-type: none"> • There is a dearth of understanding about data storage location and management. 	<ul style="list-style-type: none"> • Due to shared resources, CSP should provide secure cloud services.

Research Methodology

The literature review discussing the challenges and solutions in adopting cloud computing in Pakistan is analyzed by using SLR methodology, wherein keywords mentioned in Table 3 have opted to search relevant articles, including and excluding criteria mentioned in Table 4. A systematic literature review identifies, selects, and critically appraises research in order to answer a clearly formulated question (Dewey & Drahota, 2016).

Table 3 Keywords Selections

<p>Cloud Computing</p>	<p>Literature and conference proceedings on cloud computing in the Pakistan financial industry, particularly insurance and health insurance. Past works available since 2011 Primary and secondary research</p>	<p>Studies not in English Magazine, newspaper, thesis, report data Studies in non-financial fields, including education, manufacturing Large-scale data analytics and other technologies</p>	<p>Papers published on platforms such as Google Scholar and Emerald opted as the means of exploring this review. Following a blend of searches, terms are applied: cloud computing * AND (insurance sector*) AND (challenge* OR obstacle* OR issue* OR disadvantage* OR threat). The exploration was carried out between 2011 to 2020.</p>
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Table 4 Selection Criteria

Technology	Criteria	Kenya
<p>Cloud computing</p>	<p>Identification</p>	<p>15</p>
	<p>Screening</p>	<p>14 after removing 1 duplicates</p>
	<p>Eligibility</p>	<p>13 after removing 1 archive</p>
	<p>Included</p>	<p>12 after removing 1 full article</p>

Findings of the included studies

Systematic literature reviews yield many issues and solutions. Content analysis subcategorizes issues and solutions. Tables 57 and 58 list insurance industry challenges and solutions, respectively. The first challenge is related to the lack of cloud computing awareness, which hinders adoption and understanding of its benefits. The second issue is the time to learn new technologies (Haris, 2012). Third, privacy and security. Risks include personal data loss, unauthorized access, and misuse (Hameed & Siddiqui, 2020). Cloud service providers should instill data privacy trust. Cloud providers should provide SLAs for service level, disaster recovery, security breaches, and data loss to protect the user interests and Cloud Service Providers. Government, relevant institutions, and development agencies should educate businesses on cloud computing, economic benefits, and online services (Khan et al., 2011). Cloud agreements should secure and authenticate data. Cloud providers must follow local laws. Encryption and two-factor authentication prevent unauthorized access (Hina et al., 2017). Fourth, this technology lacks investment funds. Fifth, interoperability is important. Cloud customers cannot migrate to other vendors, service providers, or local applications to improve their systems. On-premises data centers cannot be integrated. Interoperability involves sharing processes, APIs, containers, and data models across multi-cloud environments to avoid vendor lock-in, maintain business continuity, and manage variable workloads. Dynamic component discovery and real-time data synchronization are needed. Interoperability is difficult

due to the synchronization needs of data and application components across cloud platforms (Kishore & Sanjay, 2019). Standard models and interfaces facilitate cloud provider migration (Hina et al., 2017).

The sixth issue is the loss of data governance control. Clients lose control over their resources when they pass them over to service providers. The loss of control reduces the trustworthiness of cloud computing because customers lack confidence in the technology's security features (Li & Singh, 2014). The seventh difficulty is clouding multi-tenancy isolation failure. Multi-tenancy means several clients are utilizing the resources at the same time. Inability to isolate routing, storage, memory, and reputation utilization amongst tenants. Cloud computing's multi-tenancy feature is vital. It applies to all three levels of cloud, namely IaaS, PaaS, and SaaS. Security is a major concern in multi-tenancy cloud computing. Data loss, theft, and hacking are always risking. Unauthorized access might be granted by the database administrator (Enterprise Engineering Resource, 2021).

The eighth issue is IT staffing. The cloud skills deficit is hindering rapid technological adoption. In addition to qualified individuals' need to deal with these new technologies, the COVID-19 epidemic has fueled cloud infrastructure spending. Cloud architecture, cloud security, remote data center administration, and managing heavy workload cloud applications are required skills (Hina et al., 2017). Cloud service providers should have a wide range of tools and experience (Jahangir et al., 2020). The ninth obstacle is an impression of technological compatibility with working style. A company's business processes, IT infrastructure, and corporate culture are compatible with cloud-based services. The availability of suitable ICT resources at both ends (receivers and senders) boosts cloud computing adoption. Thus, the incompatibility of cloud service prevents SMEs from using it (Zulfiqar et al., 2017). The deployment and service model should be chosen based on the requirement (Hina et al., 2017). The tenth difficulty is CEO/Manager support. Change that causes irritation and anguish. A simple and convenient Cloud Computing method is required to encourage SMEs to use cloud-based applications. They reject adoption because they cannot see the benefits. The eleventh issue is that little research has been undertaken in South Asia (Zulfiqar et al., 2017). Lastly, performance issues developed due to lengthier downtime and decreased service provider dependability. Performance is affected by storage capacity, network bandwidth, user count, data center location, and workload (Jahangir et al., 2020).

Table 5 Cloud Computing Adoption Challenges in the Pakistan Insurance Industry

Technology ignorance
Time to learn new tech
Privacy & security issues
Enormous financial need
Interoperability problems
Control over data governance
Cloud multi-tenancy isolation failure
Lack of IT experts
Impression of technology-workstyle compatibility
CEO/manager psychological determinants
Studies in south asian emerging nations like pakistan are uncommon.
Nascent stage in pakistan
There are issues with prolonged downtime and service provider dependability.

Table 6 Cloud Computing Adoption Solutions in the Pakistan Insurance Industry

Developing confidence in service providers' data privacy protection.
Protecting user interests while ensuring cloud service providers' viability and consistency should be government policy.
Cloud computing providers should give slas for service level, disaster recovery, security breach, and data loss.
Service providing, data security, privacy and regulatory requirements should be trained.
Businesses training on cloud computing & online services by the government & appropriate entities.
Cloud service providers must follow local laws.
Standard models and interfaces facilitate cloud provider migration.
The deployment and service model should be chosen according to the need.
Encryption and two-factor authentication help prevent illegal access.
To fulfil rising demand, cloud service providers need diverse tools and experience.

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