IoT Adoption Challenges and Solutions in Pakistan: A Systematic Literature Review Approach

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Abstract

Background: The concept of insurance was born many thousands of years before the birth of Christ (BC). In the second and third millennia BC, merchants from China and Babylon engaged in spreading or sharing risks. In contemporary times, insurance stands as a cornerstone of the economy, yet broadening its reach remains a challenge in developing countries. The fourth wave of the insurance sector revolution in the industrialized world was initiated by the recent emergence of Blockchain, IoT, Big Data, and InsurTech

Objective: To enhance insurance protection in Pakistan, this analysis explores the challenges associated with remedies for IoT adoption.

Research Methodology: To uncover the themes and elements related to challenges and solutions in adopting IoT within the insurance sector of Pakistan, this research conducted a thorough literature review using the Systematic Literature Review (SLR) approach. Various keywords were utilized to locate relevant material via Google Scholar. The selected studies were assessed according to specific inclusion and exclusion criteria.

Findings: This document highlighted challenges to the uptake of IoT in the insurance sector of Pakistan, along with possible solutions and viable solutions. The recommendations may assist policymakers in enhancing service provision within the insurance industry.

Keywords: ***Insurance Industry, Digital Technologies, Pakistan, Internet of Things.***
JEL Classification: G22, L86, O14

INTRODUCTION

Fintech holds the promise of transforming the financial landscape in developing nations

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such as Pakistan by facilitating access to financial services for the unbanked demographic. Initiatives in fintech, including mobile payments, digital banking, microfinance, and financial literacy programs, can effectively integrate the unbanked population into the formal financial framework, particularly in rural communities and among small business owners (Zaidi et al., 2023). Pakistan's telecommunications companies are understanding the significant role of the Internet of Things (IoT), which has great potential to increase revenue. They are also designing strategies to exploit the existing resources to leverage the IoT system, whose foundation is based on mobile connectivity. It has brought revolutionary changes in all industries, including agriculture, hospitals, and urban environments, in the fourth Industrial Revolution. Merging of IoT with cloud computing leads to optimal performance in terms of fast decision-making across various levels, especially in the consumer electronics (CE) sector in Pakistan. This adoption will get more boost due to 5G IoT technologies. In the agriculture sector, IoT adoption can reduce the poverty rate in Pakistan's rural localities through weather prediction, rural financing solutions, and livestock management (Shafique et al., 2019). As 45% of the labour force and 23.4% of the nation's GDP depend on the agricultural sector, IoT solve problems regarding crop prediction, pesticide or soil enhancement chemicals and harvest timing (Awais et al., 2023). However, there are also challenges linked with IoT in Pakistan: privacy issues, operational failure, data latency and firmware updating for smart devices. Khan & Shahzad (2024) highlighted that network instability and low bandwidth are significant barriers to the deployment of IoT devices. They note, "The infrastructure to support IoT networks in rural and semi-urban areas is not only sparse but also outdated, resulting in low adoption rates for IoT devices in sectors like smart farming. Blockchain technology has the potential to solve security and privacy issues. There are also solutions which are and analysed in this study by using a systematic literature review approach in the Pakistani context. Mobile phones can be utilized to augment revenue, enhance market efficiency, decrease transaction expenses, and foster improvements in service delivery. The Internet of Things (IoT) represents a technological phenomenon that is transforming the current landscape and will have a lasting impact on future contexts. The following are the research questions whose answers are discussed in detail in the discussion section:

What are the Challenges, along with solutions, regarding IoT Adoption in the Pakistan Insurance Industry?

LITERATURE REVIEW

The Internet of Things (IoT) faces significant obstacles in Pakistan, primarily due to the absence of necessary realignment and transformation within the agricultural sector. This shortcoming limits the potential impact of IoT technologies on alleviating poverty in rural communities (Shafique et al., 2019). Verified Market Research projects that the IoT market in financial services will exceed USD 2.61 billion by 2024. Peerbits (2025) expect that IoT will expand to USD 52.38 billion by 2031. This growth is primarily due to rising demand for automation and the need for real-time financial insights.

The author extracted pertinent data from the relevant papers, including the authors' names, publication years, countries of publication, types of publications, and their findings.. Table 1 outlines the literature included, such as articles, conference proceedings, or books, along with their methodologies and publication years. Meanwhile, Table 2 illustrates the challenges and solutions that emerged from the review of the selected studies.

Table 1. *Characteristics of reviewed IoT adoption studies in Pakistan insurance sector*

No.	Journal name/ Conference Name	Paper topic/ Conference paper Name	Method	Year	Author
1	Bull World Health Organ	E-health in low-and middle-income countries: findings from the Center for Health Market Innovations	Quantitative	2012	(Lewis et al., 2012)
2	International Journal of Scientific & Engineering Research	The impact of E-Health on clinical psychology practices and the future of E-health / Telepsychology/Telehealth in Pakistan		2021	(Ullah et al.,2021)
3	SAGE Open	Assessing the Adoption of e-Health Technology in a Developing Country: An Extension of the UTAUT Model		2021	(Gu et al., 2021)
4	Clinical eHealth	The establishment of a telemedicine center during the COVID-19 pandemic at a tertiary care hospital in Pakistan		2021	(Syed et al.,2021)
5	International Journal of Medical Informatics	Beyond COVID-19: Prospect of telemedicine for obstetrics patients in Pakistan		2022	(Suleman, 2022)
6	startup.pk	IoTSol and Internet of Things in Pakistan		2021	(Sadia, 2021)
7	International Journal of Computer Science and Information Security (IJCSIS),	Acceptance of IoT in Pakistan: A Survey		2017	(Laeeq et al., 2017)
8	Nucleus	Investigating the Adoption of Telemedicine Services: An Empirical Study of Factors Influencing Physicians' Perspective in Pakistan		2018	(Kamal, 2018)
9	Indus Journal of Management & Social Science (IJMSS)	Popularity of Tracking Device as an Anti-the Measure and Impact of its sales on Sales of Auto Insurance Policy		2009	(Hussainy et al., 2009)

Table 2. *IoT adoption in Pakistan Insurance Industry: Issues & Solutions*

No. of Studies	Issues	Solutions
Study 1	Perceived severity of health risk behavior hinders the adoption of IoT in Pakistan. User has also lack of knowledge regarding this technology Lack of cultural appropriateness. Infrastructure is also a main concern for reliable energy supply and internet accessibility	Nil
Study 2	Shortage of Internet penetration, misconduct on digital media and lack of literacy.	Awareness programs regarding the benefit of IoT system to motivate the public to adopt it especially in health insurance. Government can make legislation and infrastructure like high-speed internet connectivity and user data privacy concerns.
Study 3	Lack of knowledge of this technology benefits Lack of adequate ICT support Absence of e-health training computer-illiterate Privacy concerns	Nil

Study 4	Insufficient funding Network security Un-popularity privacy IT literacy	Nil
Study 5	Nil	Improved internet access in rural and distant locations, digital literacy, and telemedicine awareness would encourage adoption in Pakistan.
Study 6	Global regulatory frameworks for IoT services are developing. ICT enterprises in Pakistan are creating novel IoT services.	Government should develop IoT licensing, numbering and addressing, spectrum management, network standards, data protection, privacy and security, data collecting, analysis, sharing, and utilization.
Study 7	There is no previous study in the context of IoT-based healthcare in Pakistan. IoT literacy Lack of budgets Lack of awareness	Nil
Study 8	Behavioral intention	Nil
Study 9	There is a lack of comprehensive and feasible legal procedures for this technological adoption in the existing health care system. It is in infancy stage in Pakistan.	Training programs should be conducted in healthcare systems including health insurance to motivate them to adopt IoT and use telemedicine to assist patients and improve treatment efficiency by reducing travelling cost.

RESEARCH METHODOLOGY

Literature review discussing the challenges and solutions in adopting IoT in Pakistan is analysed by using SLR methodology wherein keywords mentioned in table 3 are used to search relevant articles meeting the inclusion and exclusion criteria mentioned in table 4. Systematic literature review identifies, selects, and critically appraises research to answer a clearly formulated question (Dewey & Drahota, 2016).

Table 3. *Keywords Selections*

IoT	Literature and conference proceedings on IoT in the Pakistani financial industry, particularly insurance. Past works available since 2009 Primary and secondary research	Studies not in English Magazine, newspaper, thesis, report, data Studies in non-financial fields, including education, manufacturing Large-scale data analytics and other technologies	Papers publishing platforms such as Google Scholar were opted for as the exploration means for this review. Following a blend of search, terms are applied: IoT* AND (insurance sector*) AND (challenge* OR obstacle* OR issue* OR disadvantage* OR threat). The exploration was carried out between 2009 and 2022.

Table 4. *Selection Criteria*

Technology	Criteria	Pakistan
IoT	Identification	15
	Screening	14 after 1 duplicate removing
	Eligibility	12 after removing 2 archives
	Included	9 after removing 3 full articles

RESULTS AND DISCUSSION

Systematic literature reviews yield issues and solutions. Content analysis subcategorizes issues and solutions. Table 5 lists the insurance industry's challenges, while Table 6 lists notable solutions based on their repetition. Health risk behaviour deters Pakistani IoT adoption. Smart Internet-enabled devices (IoT devices) are transforming Pakistan's healthcare system. Smart wearables' pooled health data can help doctors, healthcare providers, and patients manage illnesses proactively (Salangi et al., 2021). Increased Health Risk with susceptibility and severity will improve use of behaviour (Solanki et al., 2021). The second issue is technology ignorance and its benefits (Azhar et al., 2009). Third, cultural insensitivity. National culture predicts consumer IoT adoption. Culture affects usability. Social norms have less impact on cultures with low power distance and high individualism. Even with limited support, uncertainty, avoidance, and indulgence increase technology adoption. High-uncertainty avoidance and low-indulgence cultures need more guarantees whenmodern technology. Pakistani consumers follow and lag (Syed & Malik, 2014).

The fourth problem is infrastructure, such as high-speed internet access and electrical availability. 35% of the nation lacks adequate internet access. This includes optical fibre connections and the absence of telecom towers. The internet is not available in sixty% of Baluchistan. The national average of 6.2 Mbits per second is available in certain locations but not all (cellular only) in FATA and Gilgit-Baltistan (Uzair, 2020). Digital illiteracy is the fifth challenge. Poverty, population increase, feudal lords, low allocations, a male-dominated society, and rural illiteracy influence it (Dawn, 2018). The sixth challenge is privacy and security issues due to cyber assaults, unsecured software, firmware, web interface, and weak transport layer encryption (Kumar et al., 2019). Loss of data confidentiality, loss of privacy about passwords and pin codes results in unlawful system access (Farzana et al., 2021). The seventh challenge is lack of funding. Insurance companies lack funding for research and development. Cost drove banking ICT adoption.

Eight challenges are new IoT regulation. According to the PTA's Strategy and Development Division, the IoT is gaining popularity worldwide (Sadia, 2021). The health care system lacks realistic legal processes for implementing this technology (Shafiq et al., 2019). PTA has created a Licensing Framework for Terrestrial Internet of Things (IoT) Services for unlicensed frequency bands. The nation's IoT ecosystem must legalized in licensed and unlicensed bands (ProPK Staff, 2021). The government should regulate IoT data collection, analysis, and sharing to protect lives and businesses. Pakistani ICT companies are developing IoT services. Health insurance should promote IoT system benefits. IoT confuses Pakistanis. Customers were not IoT-savvy, so they had trouble choosing a device.

Ninth, Pakistan has few Core IoT companies. Karachi and Lahore hosted Telenor IoT

awareness events. Pakistan will host Telenor IoT Expo (Aman et al., 2016). PTA headquarters hosted an IoT awareness event. Syed Ismail Shah, Member (Finance), Tariq Sultan, Member (Compliance & Enforcement), Abdul Samad, top PTA officers, telecom officials, and academics attended (PTA, 2015). The government should regulate data collection, analysis, sharing, and use (Tahir, 2020). Lastly, Pakistan lacks IoT-based healthcare research (Sadia, 2021). There is a lack of research-specific training institutions and infrastructure (Umer, 2019). Hira et al. (2022) mentioned that high-speed internet and data privacy canvas should be provided. Doctors and staff may use mobile wallets and physical exam stations at hospitals. Pakistan will use IoT due to improved rural and remote internet connectivity, digital literacy, and telemedicine awareness.

Table 5. *IoT Adoption Challenges in the Pakistan Insurance Industry*

• The perceived severity of health risks in Pakistan deter IoT adoption.
•The user is also ignorant about the technology.
•Lack of cultural sensitivity.
•Infrastructure is important for dependable electricity and internet access.
•Digital illiteracy
•Privacy & secuirty concerns
•Paucity of funds
•Globally, IoT regulation is still in its infancy.
•International and local ICT enterprises are in the process of creating IoT-based services in Pakistan.
•There is no prior research in pakistan on IoT-based healthcare.

Table 6. *IoT Adoption Solutions in Pakistan Insurance Industry*

•Programs to educate the public on the benefits of IoT, especially in health insurance.
•Legislation & infrastructure i.e. High-speed internet connection and user data privacy.
•Hospitals need consultant and employee training, regional language communication,
•accessible physical exam venues, and mobile wallet payment options.
•Better rural and remote internet connectivity, digital literacy, & telemedicine awareness.
•Government should develop IoT regulations for licensing numbering and addressing,
•Spectrum management, network standards, data protection, privacy and security, data collecting,
•Analysis, sharing, and usage.

CONCLUSION

Pakistan's insurance industry faces the following challenges in adopting IoT: Health risk behaviour, a lack of technological awareness, cultural insensitivity, inadequate infrastructure, digital illiteracy, privacy concerns, a lack of funding, weak regulatory frameworks, and a lack of core IoT companies. Even though IoT can potentially revolutionise industries like healthcare by facilitating proactive initiative-taking, disease management, and enhancing overall efficiency. These obstacles prevent their widespread adoption. While government programs and IoT awareness events are encouraging more all-encompassing approaches are needed to promote IoT adoption effectively.

LIMITATION

The issues found result from a thorough literature review and content analysis, which

might not adequately represent the dynamic and quickly changing technological environment. Furthermore, examines IoT adoption in the financial industry, including insurance, potentially ignoring other industries where IoT can have a revolutionary impact. The result by a lack of empirical research in the Pakistani context and restricted data availability.

RECOMMENDATION

Enhanced Infrastructure:

To overcome connectivity obstacles, the government should prioritise expanding high-speed internet access, especially in underserved areas like Baluchistan, Gilgit-Baltistan, and FATA.

Awareness and Education:

To close the knowledge gap between consumers and industry stakeholders. Nationwide campaigns can be done to promote digital literacy, technological awareness, and the advantages of the Internet of Things.

Regulatory Frameworks:

Create and implement strong IoT-specific laws that address ethical security and data privacy issues to win over customers and protect companies.

Funding and Incentives:

To promote innovation and adoption across various industries, provide funding and tax incentives for IoT research and development.

Cultural Sensitivity:

To increase usability and acceptance, culturally sensitive IoT solutions should be adapted to conform to local and national cultural norms.

Healthcare Research and Development:

To create context-specific solutions for Pakistan's healthcare system, specialized institutions for IoT-based healthcare research and training can be established.

Public-Private Partnerships:

To establish an environment that is favourable for the adoption of IoT, encourages cooperation between governmental organizations, businesses, and academic institutions.

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