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Cloud-Based Hospital Information System Adoption: The Roles of System Flexibility, Ease of Use, Perceived Security, and Digital Literacy

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ABSTRACT

Cloud-based hospital information systems have emerged as a significant component of the digital transformation in healthcare management, as they help hospitals to enhance operational efficiency, coordination of services, accessibility of data, and decision making. This paper analyzes the drivers of cloud-based hospital information system adoption by paying attention to system flexibility, ease of use, perceived security, and digital literacy. The study places system flexibility, usability, and security as determinants of organizational and technological capabilities that can facilitate healthcare information system adoption, and digital literacy is considered as a moderating variable that reinforces the relationship between these factors of system adoption and system adoption. The research design chosen was a quantitative one, and 450 staff members in healthcare were surveyed using a structured questionnaire. Partial Least Squares Structural Equation Modeling of Smart-PLS was used to analyze the proposed model. Measurement model was checked based on reliability, convergent validity, and discriminant validity whereas the direct and moderating effects were tested based on structural model. The results indicate that there are great positive impacts of system flexibility, ease of use and perceived security on the adoption of cloud-based hospital information systems. The findings also reveal that the impact of system flexibility, ease of use, and perceived security on system adoption are reinforced when digital literacy is high, implying that those healthcare employees with higher digital literacy are in a better position to comprehend, accept, and utilize cloud-based hospital information systems. By clarifying the ways in which the attributes of technological systems and the digital capability of employees work together to influence the adoption of cloud-based systems, the study contributes to the literature on healthcare management and digital transformation. In practice, the results can guide hospital administrators, healthcare managers, policymakers, and technology vendors to enhance the usability of the system, increase security capabilities, improve the flexibility of the platform, and create digital literacy training to achieve successful adoption of healthcare technology.

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1. Introduction

Healthcare institutions across the world have built an extensive network of cloud-based hospital information systems (CHIS) because of digital technology's fast developmental pace. These healthcare systems offer enhanced efficiency for hospital management of patient records with administrative data and clinical workflow through their features of scalability and remote accessibility and cost-saving potential (Ahmed et al., 2020). Cloud computing in healthcare has transformed traditional paper-based processes into automated and data-driven environments, ensuring real-time access to critical patient information and enhancing overall healthcare service delivery (Al-Okaily, 2024). Despite these advancements, the adoption of CHIS is not uniform across healthcare organizations, as several factors influence their acceptance and implementation.

Cloud-based systems are widely recognized for their ability to improve healthcare efficiency and patient care outcomes. However, their adoption is influenced by multiple organizational, technological, and individual factors (Al-Qerem et al., 2025). While the advantages of CHIS include improved data management, reduced medical errors, and enhanced decision-making capabilities, concerns related to security, system flexibility, ease of use, and digital literacy continue to hinder widespread acceptance (Alsyouf, Ishak, Lutfi, Alhazmi, & Al-Okaily, 2022). Given the increasing reliance on digital technologies in healthcare, understanding these factors is essential for effective CHIS implementation.

The healthcare industry is undergoing digital transformation, with cloud-based systems playing a crucial role in data integration, interoperability, and real-time decision-making (Dajani, Yaseen, El Qirem, et al., 2022). CHIS enables healthcare professionals to access patient information anytime and anywhere, fostering continuity of care and reducing redundant medical tests (Hung et al., 2023). Additionally, cloud-based solutions facilitate collaboration among healthcare providers, enhancing the coordination of patient care and treatment planning (Liao, Liu, & Chen, 2011). Despite these advantages, healthcare institutions often face resistance to CHIS adoption due to concerns about data privacy, cybersecurity risks, and system adaptability (Al-Reqeb, 2024).

One of the primary motivations for adopting CHIS is its potential to improve hospital efficiency. By reducing manual paperwork and administrative burdens, cloud-based systems allow healthcare professionals to focus on patient care rather than administrative tasks (Naamati-Schneider & Alt, 2024). Moreover, CHIS supports evidence-based medical practices by providing instant access to updated clinical guidelines and research findings (Syah et al., 2023). However, these benefits can only be realized if healthcare professionals perceive the system as user-friendly, secure, and flexible to their needs (Leong et al., 2017).

Despite the potential benefits, the adoption of CHIS is fraught with challenges that limit its effectiveness. Security concerns remain one of the most significant barriers to adoption, as healthcare institutions handle sensitive patient data that must be protected against unauthorized access and cyber threats (Mustafa et al., 2022). Studies have highlighted that perceived security risks negatively impact users' willingness to embrace cloud-based solutions in healthcare (Safdar et al., 2022). Consequently, hospitals must implement stringent cybersecurity measures, including encryption, access controls, and data backup protocols, to enhance trust in CHIS (Al-Somali et al., 2024b).

Another critical challenge in CHIS adoption is system flexibility. The operational workflows of hospitals differ from each other requiring CHIS systems to have flexibility across various clinical and administrative requirements (Idoga et al., 2019). An inflexible information system which neglects hospital-specific requirements triggers negative reactions from healthcare staff and administrative personnel (Mijin et al., 2017). Research shows that hospitals tend to select CHIS with customizable features as well as interoperability because these systems will smoothly connect with their current hospital information systems (Halasa, 2024).

The simplicity of using the CHIS system matters when healthcare providers choose to adopt it. Healthcare professionals tend to stay away from using complex systems that are difficult to understand because such systems challenge their workflow efficiency (Alsyouf et al., 2023). The adoption of new technology relies heavily on usability because users prefer

systems that both are simple to understand and navigate (Alterkait & Alduaij, 2024). Training together with support programs for users solve usability problems so healthcare professionals maintain efficient performance of CHIS for both patient care and administrative work (Naamati-Schneider & Alt, 2024).

Healthcare professionals need proper digital competence to successfully operate CHIS cloud-based systems (Junaedi et al., 2024). The adoption of CHIS requires additional training for medical staff who exhibit limited digital literacy skills (Babalola et al., 2024). Digital technologies can improve service quality only when users possess the skills required to understand, access, and apply them effectively in organizational settings (Alemán de la Garza et al., 2019). Studies show that improved digital competence of workers leads both users and providers to perceive cloud-based healthcare technology as more effortless to operate and beneficial to their activities (Eric et al., 2024). The healthcare system requires hospital administrators to establish capacity-building programs that will enhance staff members' digital competencies (Farooq & Bashir, 2023).

The purpose of this research is to study how key determinants affect cloud-based hospital information system adoption rates among healthcare professionals because such systems have gained vital importance yet face implementation barriers. The proposed research targets four key elements which affect Cloud-based Hospital Information System adoption: system flexibility, ease of use, perceived security and digital literacy. An evaluation of digital literacy as a factor which strengthens the effects between these variables on system adoption takes place in this research.

This research identifies CHIS adoption factors which strengthen the current studies about healthcare information systems and delivers actionable insights to healthcare administrators and technological suppliers and policymakers. Designing CHIS needs to integrate healthcare professional requirements because this knowledge helps achieve successful deployments across all medical facilities (Kar, 2021). The research findings will deliver beneficial knowledge about implementing strategies to deal with CHIS adoption challenges while maximizing cloud-based healthcare solution capabilities (Mekurianew Kelkay et al., 2024).

Hospital information systems based in the cloud help medical organizations through operational advantages that increase teamwork capabilities and enhance decision quality. Healthcare institutions decide to implement these systems after weighing multiple elements which include system adaptability together with user simplicity along with security fears and workforce digital skills level. Developing technologies combined with user education and state policies constitute a detailed solution to these problems. The research findings about CHIS adoption elements form the basis for developing effective strategic plans that promote digital transformation within healthcare organizations.

2. Literature Review

2.1. System Flexibility and CHIS Adoption

Healthcare institutions need to choose a flexible system setup as their primary decision factor while adopting cloud-based hospital information systems (CHIS) because such systems allow institutions to personalize their needs (Ahmed et al., 2020). The ability of a system to adapt makes it suitable for integration into hospital operations thus healthcare staff show less opposition to implementation (Al-Okaily, 2024). System flexibility fosters widespread adoption among users but strict limitations placed on a system model become barriers to its acceptance (Al-Qerem et al., 2025). The healthcare environment requires flexible systems since it exists with departmental divisions requiring unique features according to (Alsyouf, Ishak, Lutfi, Alhazmi, & ... 2022). The acceptance of CHIS by users remains positive as long as the system proves its ability to comply with both medical procedures and regulatory protocols (Idoga et al., 2019). At the same time, flexible digital systems are more likely to be adopted when employees can adapt technology to their work processes and receive opportunities for continuous upskilling (Chakravarti, 2023). The research hypothesis divides into the following statement:

H1: A system's capability to adapt functions positively influences healthcare staff members toward adopting information systems.

2.2. Ease of Use and CHIS Adoption

Hospital professionals adopt cloud-based information systems faster because they desire systems that need little training for both learning and operation (Dajani, Yaseen, Qirem, et al., 2022). An intuitive along with user-friendly system minimizes both cognitive overload and productivity enhancement (Hung et al., 2023). Systems that have challenging learning requirements generate more implementation hurdles and therefore receive reduced acceptance from users (Liao et al., 2011). The acceptance of CHIS along with user satisfaction grows when the system design includes interfaces that are easy to use and exhibits clear navigation and system responsiveness (Leong et al., 2017). Successful system implementation occurs more frequently in hospitals which dedicate investments to improve usability functions combined with worker training programs (Naamati-Schneider & Alt, 2024). Our research hypothesis becomes the following statement:

H2: The adoption of CHIS is positively affected when systems are designed to be easily used by personnel.

2.3. Perceived Security and CHIS Adoption

Organizations failures to meet security expectations remain the most influential factor which prevents CHIS adoption. The management of sensitive patient data at healthcare institutions demands security to be their highest priority (Mustafa et al., 2022). Users avoid using cloud solutions because they worry about unauthorized access combined with data breaches and system weaknesses (Al-Somali et al., 2024a). User trust and platform usage willingness toward cloud-based systems heavily depend on security perceptions according to research by Safdar et al. (2022). Increased adoption of CHIS depends on implementing strong security practices including encryption protocols and multi-factor authentication along with secure access restrictions (Shahzad et al., 2020). Healthcare providers tend to adopt CHIS into their everyday operations when they view CHIS as a secure platform (Eric et al., 2024). Here our formulated research hypothesis states that:
H3: Perceived security will have a positive effect on CHIS adoption.

2.4. Digital Literacy and CHIS Adoption

Digital literacy is closely associated with 21st-century skills, including problem solving, digital communication, collaboration, and the ability to work effectively in technology-supported environments (Basnal, 2022; Chakravarti & Stevenson, 2022). The level of digital literacy establishes a significant impact on healthcare facilities adopting cloud-based healthcare systems. Healthcare professionals who comprehend digital systems and technology better demonstrate greater comfort with new technologies as well as digital transformation implementation (Junaedi et al., 2024). Research demonstrates that insufficient digital capabilities serve as implementation obstacles for CHIS because users encounter difficulties using their system features (Babalola et al., 2024). Stakeholders who develop digital literacy training initiatives experience increased technology adoption with better CHIS usage (Olomiyete, 2024). System ease of use perception improves for users who possess digital literacy skills because their mastery of technology means they face less difficulty when they learn and interact with CHIS (Farooq & Bashir, 2023). Our research hypothesis should state: H4: Digital literacy has a positive effect on the adoption of CHIS.

2.5. Moderating Role of Digital Literacy

Digital literacy functions both as an independent factor for predicting CHIS adoption and as a factor which enhances other essential adoption factors' power. People with advanced digital literacy skills possess the capabilities needed to make the most out of system adjustability because they can modify system features according to their requirements (Naamati-Schneider & Alt, 2024). Users who possess digital literacy skills experience less difficulty with system learning and gain higher confidence thus improving their ease of use perception (Kar, 2021). Users who show high levels of digital competency measure security features more effectively which creates stronger trust in the system and thus affect their

willingness to adopt (Mekurianew Kelkay et al., 2024). By fostering digital literacy among healthcare professionals, hospitals can maximize the effectiveness of CHIS adoption (Naamati-Schneider & Alt, 2024). Keeping in view the role of digital literacy in HIS adoption, we can formulate our research hypotheses such as:

H5a: Digital literacy moderates the relationship between system flexibility and CHIS adoption, such that the positive relationship is stronger for users with higher digital literacy.
H5b: Digital literacy moderates the relationship between ease of use and CHIS adoption, such that the positive relationship is stronger for users with higher digital literacy.
H5c: The entire relationship between perceived security and CHIS adoption receives stronger strength from users who demonstrate high digital literacy levels (i.e., digital literacy moderates the relationship).

2.6. Summary of Literature Review

The preceding literature review along with postulated hypotheses appears in the table 1.

Table 1
Summary of Literature Review: Key Findings and Hypotheses

Factor	Key Findings	Hypothesis
System Flexibility	Adaptable systems encourage adoption	H1: System flexibility positively influences CHIS adoption.
Ease of Use	User-friendly systems enhance adoption	H2: Ease of use positively influences CHIS adoption.
Perceived Security	Secure systems increase user trust and adoption	H3: Perceived security positively influences CHIS adoption.
Digital Literacy	Higher digital literacy increases system adoption	H4: Digital literacy positively influences CHIS adoption.
Moderating Role of Digital Literacy	Strengthens the effects of system flexibility, ease of use, and perceived security on CHIS adoption	H5a, H5b, H5c

The introductory part of this assessment builds the theoretical underpinnings by emphasizing how system flexibility and easy usability and perceived security and digital competence impact CHIS adoption. Testing research hypotheses constructed from literature findings will happen in subsequent sections of this research to validate their accuracy and application for medical technology adoption processes.

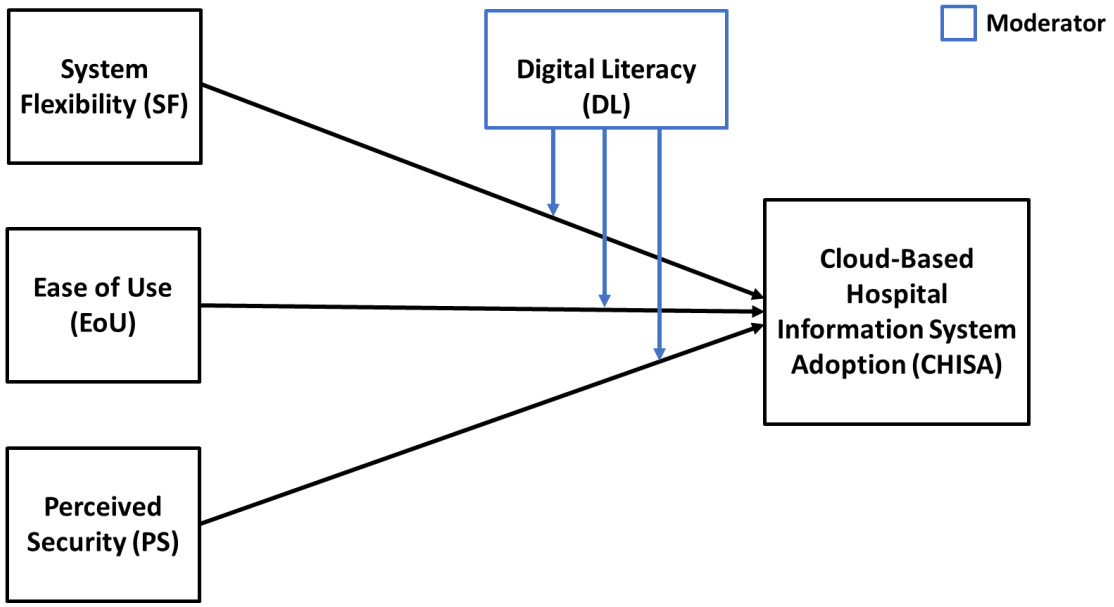

Figure 1: ***The Structural Model Representing the Hypothesized Relationships Among the Constructs***

3. Data And Methodology

3.1. Research Design

The research design of this study uses quantitative methods to examine the elements that affect hospital information system (CHIS) adoption through cloud-based technology. The research design takes a cross-sectional approach because it gathered data at one point to analyze key variable relations. This study bases its research on the Technology Acceptance Model TAM in combination with the Unified Theory of Acceptance and Use of Technology UTAUT to investigate CHIS adoption. The main research aim focuses on how system flexibility and ease of use as well as perceived security and digital literacy impact CHIS adoption and particularly how digital literacy acts as a moderating factor.

3.2. Population and Sampling

Healthcare professionals from multiple hospitals across China form the study population since they represent physicians and nurses as well as IT personnel and administrative staff who actively engage with hospital information systems. Research participants were selected through purposive sampling because of their experience in CHIS utilization. A representative sample was achieved by pursuing 450 possible respondents. The research sample meets the requirements of Partial Least Squares Structural Equation Modeling (PLS-SEM) because it provides an adequate number of data points to maintain reliable statistical outputs. Three necessary criteria applied to potential participants included current CHIS usage at work and digital system familiarity together with clinical or administrative responsibilities.

3.3. Data Collection Method

Healthcare professionals in China received a structured questionnaire through combination online and offline distribution methods. A set of carefully crafted closed-ended survey questions existed in the questionnaire to assess the essential elements within the research framework. A preliminary test with selected healthcare professionals checked the clarity and validity and measurement reliability of all survey questions. The participants received guarantees about both personal information secrecy and survey identity protection to motivate them for sincere answers. The survey contained questions about participant demographics as well as their system usage history and their opinions regarding CHIS adoption factors. A three-month data collection period enabled the achievement of both high response rates and quality data.

3.4. Measurement of Variables

Validated scales obtained from earlier research studies were employed for construct evaluation to guarantee reliability and validity. Survey participants evaluated the constructs through a Likert scale format which contained responses from 1 (strongly disagree) to 7 (strongly agree).

The System Flexibility construct (based on (Goodhue, 1995) evaluates the adaptive nature and responsive behavior of CHIS through its measurement items. The simplicity and user-friendliness characteristics of CHIS are evaluated using items adapted from Venkatesh and Davis (2000) Technology Acceptance Model (TAM2)’s Ease of Use subset. PS measures data protection alongside system encryption and system trustworthiness according to Chiu et al. (2009). Users measures Digital Literacy (DL) through an adjusted version of tools as used by Hargittai (2005) which assesses their technical skills and knowledge about digital tools. Data collection for CHIS Adoption (CHISA) employs items drawn from the Unified Theory of Acceptance and Use of Technology (UTAUT) model (Venkatesh et al., 2003) that emphasize performance improvement and efficiency together with productivity. All items included in the constructs are specified within the appendix.

3.5. Data Analysis Technique

The researchers used Smart-PLS (Partial Least Squares Structural Equation Modeling) as their main data analysis program. This study employs PLS-SEM because it provides efficient analysis of numerous latent variables relationships in addition to its capability to

work with small to moderate sample datasets effectively. The examination included steps for evaluating the measurement model along with steps for estimating the structural model. The study assessed construct reliability and validity by using factor loadings and evaluating both composite reliability (CR) and Cronbach's alpha and average variance extracted (AVE). Path coefficients together with t-statistics and p-values analyzed the relations proposed in the study. The study looked at how digital literacy modifies the effects between system flexibility, ease of use, perceived security and adoption of CHIS. The explanatory power of independent variables was determined using R^2 values alongside effect sizes (f^2).

3.6. Ethical Considerations

The institutional review board granted their necessary approval, which made data collection activities possible. Study participants received detailed information which included their free willingness to participate along with guarantees that their data would stay protected before beginning the research. The study began by receiving authorization to distribute the questionnaire while assuring confidentiality on research findings which would only be used for this study. Anonymity protection existed throughout the research together with an open option for study withdrawal anytime by any participant. The research study adopted ethical standards for human subject work to establish neutrality and preserve informative clarity together with participant confidentiality.

4. Results and Discussion

4.1. Convergent Validity Assessment

The convergent validity test results can be found in table 2 to show strong associations between measurement items and corresponding constructs. Results from the convergent validity test appear in this table which shows factor loadings and displays Cronbach's alpha together with composite reliability (CR) and average variance extracted (AVE) for Digital Literacy (DL), Ease of Use (EOU), Perceived Security (PS), Cloud-based Hospital Information System Adoption (CHISA) and System Flexibility (SF).

Each item in the measurement model shows its direct connection with its corresponding construct through its calculated factor loading. All items demonstrate strong indicators of their corresponding constructs since their loadings surpass the required threshold of 0.70. The items that measure Digital Literacy demonstrate strong performance as indicated through their loadings which fall between 0.864 and 0.909. Data shows that each item measuring system ease of use has a strong relationship with this dimension of the system design with values between 0.899 and 0.920. All security-related items demonstrate exceptional construct alignment with a factor loading scale between 0.911 and 0.924 based on analysis. System adoption through the CHISA construct achieves loadings from 0.87 to 0.888 because all five items demonstrate substantial contribution to the total construct measurement. System Flexibility received high factor loadings between 0.912 and 0.93 which proves the measurement items effectively identify system flexibility.

Cronbach's alpha evaluates how consistently the constructs perform in relation to their individual components. Research reliability is deemed acceptable when the value exceeds 0.70 but becomes excellent when values reach or exceed 0.90. All constructs perform well in internal consistency tests with Cronbach's alpha values surpassing 0.90. The reliability measurements for the constructs indicate Digital Literacy has an alpha score of 0.942 followed by Ease of Use with 0.958 then Perceived Security with 0.953 then CHISA with 0.928 and System Flexibility with 0.956. The values from these measures demonstrate close relationships along with reliability among the construct items.

Researchers use Composite reliability (CR) to determine how reliable their construct measurement truly is. A value exceeding 0.70 indicates appropriate reliability according to research standards and every construct in this study surpasses this benchmark. The composite reliability scores for Digital Literacy stand at 0.954 and Ease of Use measures 0.966 followed by Perceived Security at 0.964 then CHISA at 0.946 and lastly System Flexibility at 0.966. The research demonstrates that all constructs demonstrate strong internal reliability which proves their items precisely measure identical concepts.

There is a significant correlation between the construct variance and measurement error variance that researchers measure using Average Variance Extracted (AVE). The acceptance threshold for construct validity is a measurement value exceeding 0.50 and values above 0.70 indicate robust validity. The measurements for each construct account for more than 70% of its total variance as indicated by their AVE values above 0.70. AVE values indicate Digital Literacy has 0.774, Ease of Use has 0.825, Perceived Security has 0.842, CHISA has 0.777, and System Flexibility has 0.851. The measurement results verify that each construct's item inclusively measure the intended concepts effectively.

Table 2
Convergent Validity Test

Constructs	items	Loading	Alpha	CR	AVE
DL	DL1	0.884	0.942	0.954	0.774
	DL2	0.864			
	DL3	0.909			
	DL4	0.884			
	DL5	0.87			
	DL6	0.868			
EOU	EOU1	0.902	0.958	0.966	0.825
	EOU2	0.907			
	EOU3	0.911			
	EOU4	0.92			
	EOU5	0.911			
	EOU6	0.899			
PS	PS1	0.911	0.953	0.964	0.842
	PS2	0.924			
	PS3	0.919			
	PS4	0.921			
	PS5	0.914			
CHISA	CHISA1	0.87	0.928	0.946	0.777
	CHISA2	0.877			
	CHISA3	0.885			
	CHISA4	0.886			
	CHISA5	0.888			
SF	SF1	0.93	0.956	0.966	0.851
	SF2	0.912			
	SF3	0.92			
	SF4	0.924			
	SF5	0.928			

4.2. Discriminant Validity Assessment: HTMT Ratio Analysis

The table provides the outcomes from the Heterotrait-Monotrait (HTMT) ratio analysis for determining structural equation modeling discriminant validity. The model's discriminant validity demonstrates that individual measures remain separate from other measures in the model and their variables show minimal overlap. HTMT provides a ratio technique that examines construct correlations and evaluates this value relative to internal construct correlations. The accepted measure for HTMT values reaches 0.85 therefore values below that point prove that constructs maintain separate distinctions.

The table 3 results demonstrate that all HTMT ratios remain beneath 0.85 to validate discriminant validity. The highest correlation is between Digital Literacy and CHISA at 0.586, which indicates a moderate relationship but still falls within an acceptable range. The correlation between Ease of Use and CHISA is 0.396, suggesting a weaker relationship between these constructs. The correlation between Perceived Security and CHISA is 0.482, which also indicates a moderate relationship, while System Flexibility and CHISA have a correlation of 0.413, showing that these two constructs are distinct but related.

For the other constructs, the relationship between Digital Literacy and Ease of Use is 0.591, which suggests a moderate correlation, but the constructs remain distinguishable. Digital Literacy and System Flexibility have a correlation of 0.58, again confirming that they are related but not redundant. The correlation between Perceived Security and Digital Literacy is 0.032, which is very low and indicates that these constructs are almost entirely distinct. Similarly, the correlation between Perceived Security and Ease of Use is 0.055, suggesting that the perception of security does not strongly influence how easy the system is to use.

System Flexibility and Ease of Use have a correlation of 0.091, confirming that they are distinct constructs. The analysis shows that System Flexibility and Perceived Security have no significant relationship based on their 0.041 correlation value.

Table 3
HTMT Ratio

	CHISA	DL	EOU	PS	SF
CHISA					
DL	0.586				
EOU	0.396	0.591			
PS	0.482	0.032	0.055		
SF	0.413	0.58	0.091	0.041	

4.3. Discriminant Validity Assessment: The Fornell-Larcker Criterion

The Fornell-Larcker criterion provides results through a table 4 for confirming discriminant validity within the structural model context. Each construct in the model possesses discriminant validity when it keeps its unique identity separate from other variables and measures a specific model component. Each construct's square root of average variance extracted (AVE) receives comparison to the link strengths between that construct and all other constructs in the model through the Fornell-Larcker criterion. A construct demonstrates sufficient discriminant validity by showing a square root of AVE value that exceeds its linkages with all other constructs. Table 4 presents square root AVE values along its main diagonal while it shows construct correlations throughout the rest of the table. The square root of AVE for CHISA (0.881) exceeds all its correlations with Digital Literacy (0.549), Ease of Use (0.374), Perceived Security (0.455) and System Flexibility (0.391). This confirms that CHISA is distinct from the other constructs.

The square root of AVE for Digital Literacy is 0.88, which is greater than its correlations with CHISA (0.549), Ease of Use (0.563), Perceived Security (0.019), and System Flexibility (0.55). This indicates that Digital Literacy is conceptually separate from the other constructs. Ease of Use has a square root of AVE value of 0.908, which is higher than its correlations with CHISA (0.374), Digital Literacy (0.563), Perceived Security (0.037), and System Flexibility (-0.085). This confirms that Ease of Use is an independent construct. Perceived Security has a square root of AVE value of 0.918, which is greater than its correlations with CHISA (0.455), Digital Literacy (0.019), Ease of Use (0.037), and System Flexibility (0.029). The data confirms Perceived Security exists as an autonomous construct branching away from all other elements. System Flexibility has a square root of AVE value of 0.923 which exceeds its relationships with CHISA (0.391) and Digital Literacy (0.55) and System Flexibility (0.085) and Perceived Security (0.029). The analysis confirms System Flexibility exists as a distinct construct in this model structure.

Table 4
Fornell Larcker

	CHISA	DL	EOU	PS	SF
CHISA	0.881				
DL	0.549	0.88			
EOU	0.374	0.563	0.908		
PS	0.455	0.019	0.037	0.918	
SF	0.391	0.55	-0.085	0.029	0.923

4.4. Discriminant Validity Assessment: Cross-loadings

The table 5 showcases the measurement of construct-related items with their primary constructs as well as all other variables used in the model analysis. Discriminant validity assessment utilizes cross-loadings to verify that measurement items link better to their primary construct rather than other constructs. The assessment of discriminant validity succeeds when the factor loadings for items on their assigned construct exceed all their alternative construct loadings.

The measurement results establish that every assessment instrument displays its highest value with the corresponding construct while maintaining distinctiveness between all

related constructs. The five CHISA (Cloud-based Hospital Information System Adoption) items demonstrate their highest connection to the construct through loading values that range from 0.87 to 0.888. The construct loadings of CHISA fall below all other constructs at 0.284 through 0.526. The exclusive nature of these items proves them effective at measuring CHISA independently from the other constructs.

All items measuring Digital Literacy produce their maximum standardized loads (0.864 to 0.909) on the digital Literacy construct. Each item has its strongest connection to its intended construct Digital Literacy with values of 0.284 to 0.526 and subsequent loadings on CHISA and other measures being at least five times lower between -0.028 to 0.542. The assessment of Digital Literacy utilizes measurement items whose strength of association points solely to Digital Literacy which helps demonstrate its unique position in the model. Ease of Use constructs achieve their highest measurement values ranging from 0.899 to 0.92 when assessing all six related items. All six items demonstrate reduced loadings on CHISA, Digital Literacy, Perceived Security and System Flexibility which fall between -0.124 and 0.548. The analysis of Ease-of-Use measurement items indicates that these items function separately to evaluate this construct which supports the domain reliability of the construct.

The Perceived Security items demonstrate the highest loadings for their construct with corresponding values between 0.911 and 0.924. Other construct variables including CHISA, Digital Literacy, Ease of Use, and System Flexibility show minimal loading effect of 0.009 to 0.398 with the main factor. The overall measurement of Perceived Security stands uniquely in the model since it maintains no substantial associations with the other constructs. System Flexibility achieve the strongest loadings of 0.912 to 0.93 among all standardized factor loadings in their respective construct. Other constructs namely CHISA, Digital Literacy, Ease of Use and Perceived Security show lower loadings with related values between -0.124 and 0.536. The defined nature of the construct emerges clearly from these results since they demonstrate distinct separation from the other constructs.

Table 5
Cross Loadings

	CHISA	DL	EOU	PS	SF
CHISA1	**0.87**	0.454	0.334	0.423	0.308
CHISA2	**0.877**	0.451	0.33	0.381	0.314
CHISA3	**0.885**	0.496	0.346	0.383	0.354
CHISA4	**0.886**	0.526	0.352	0.403	0.371
CHISA5	**0.888**	0.489	0.284	0.415	0.374
DL1	0.468	**0.884**	0.46	0.01	0.523
DL2	0.501	**0.864**	0.506	0.031	0.418
DL3	0.509	**0.909**	0.542	0.039	0.473
DL4	0.495	**0.884**	0.502	0.022	0.486
DL5	0.46	**0.87**	0.483	-0.028	0.493
DL6	0.463	**0.868**	0.474	0.021	0.517
EOU1	0.337	0.502	**0.902**	0.065	-0.065
EOU2	0.355	0.548	**0.907**	0.045	-0.05
EOU3	0.324	0.509	**0.911**	0.038	-0.077
EOU4	0.349	0.51	**0.92**	0.069	-0.088
EOU5	0.345	0.526	**0.911**	0.025	-0.077
EOU6	0.326	0.471	**0.899**	-0.045	-0.111
PS1	0.398	0.015	0.046	**0.911**	0.005
PS2	0.375	0	-0.005	**0.924**	0.045
PS3	0.439	0.014	0.054	**0.919**	-0.009
PS4	0.45	0.052	0.056	**0.921**	0.055
PS5	0.418	0	0.012	**0.914**	0.038
SF1	0.372	0.513	-0.057	0.046	**0.93**
SF2	0.328	0.48	-0.124	0.021	**0.912**
SF3	0.335	0.503	-0.082	-0.012	**0.92**
SF4	0.388	0.501	-0.085	0.043	**0.924**
SF5	0.376	0.536	-0.053	0.031	**0.928**

4.5. Measurement Model

The diagram (figure 2) explains the Measurement Model for studying cloud-based hospital information system adoption through PLS-SEM (Partial Least Squares Structural Equation Modeling). The diagram shows visual connections that exist between unobserved

constructs along with their designated indicator variables. System Flexibility (SF) and Ease of Use (EOU) and Perceived Security (PS) and Digital Literacy (DL) figure as blue circles because they belong to the latent construct group. Both CHISA (Cloud-Based Hospital Information System Adoption) and this group are showcased in the diagram. The yellow boxes show the measurement items which measure each construct with their corresponding factor loadings.

The values displayed along connecting lines between latent constructs and their indicator variables reflect indicator strength in measuring their associated constructs. The indicator reliability demonstrates strong performance because all measurements exceed 0.70. The five observed indicators CHISA1 to CHISA5 effectively measure system adoption through their high loadings ranging from 0.870 to 0.888. The six indicators of Digital Literacy demonstrate excellent reliability because all scores are above 0.86. The measurement items for EOU, PS and SF achieve high factor loadings above 0.89 indicating valid construct representation.

The construct relationships appear as lines that connect latent variables while displaying numerical indicatives for their correlation degrees. Digital Literacy creates a moderating effect on the relationships linking System Flexibility to Ease of Use and Perceived Security along with CHISA adoption. This effect is illustrated through the use of dashed lines.

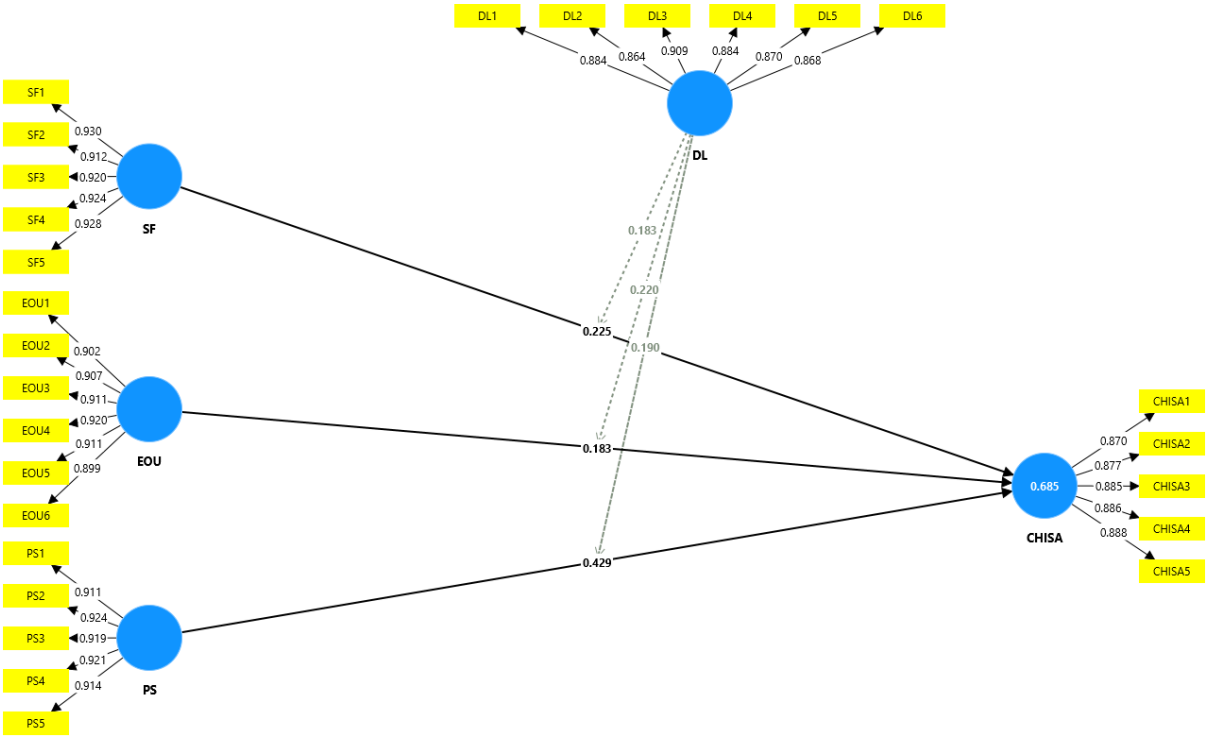

Figure 2: Measurement Model

4.6. The Path Analysis Results

A Path Analysis of different factors (Table 6) influencing CHISA adoption showed direct effects according to the presented results. The O column shows the precise paths between CHISA adoption and its independent variables as estimated by the original data. The relationships between independent variables and CHISA adoption become stronger when coefficient values grow higher. An average of bootstrapped sample estimates in the M column shows close agreement with original sample data to show stable results. The STDEV column shows coefficient estimate variation and displays precision through its smaller values. The T-statistics show the ratio between the path coefficient and its standard error whereas T-statistics greater than 1.96 establish statistical significance at the 95% confidence level. Statistical significance of relationships depends on the p-value outcome and values under 0.05 indicate their statistical significance.

The analysis shows Digital Literacy (DL) and CHISA exhibit a strong path relationship with 0.304 as the coefficients and 6.313 as the t-statistic and 0.000 as the p-value. Higher digital literacy increases the adoption effectiveness of CHISA because healthcare professionals who demonstrate stronger digital competencies tend to adopt the system better.

A positive significant relationship exists between the Ease of Use (EOU) and CHISA due to its path coefficient value of 0.183 and t-statistic of 4.327 and p-value of 0.000. The results indicate that simpler interaction methods among medical staff for system use directly impacts adoption thus confirming the critical role of convenient hospital information systems. Perceived Security (PS) demonstrates the strongest direct relationship to CHISA across all several variables within the study based on a path coefficient of 0.429 along with a t-statistic of 16.130 and p-value set at 0.000. The study demonstrates that perceived security plays a dominant role in system adoption since medical staff demonstrates increased usage of CHISA after establishing faith in security systems that protect their data through encryption and privacy measures and access management principles.

System Flexibility (SF) fosters CHISA adoption through its statistically significant relationship shown by 0.225 path coefficient and 5.723 t-statistic and 0.000 p-value. The flexibility of hospital information systems to customize itself enables better adoption because users require systems which fit diverse organizational needs. Digital Literacy (DL) acts as a moderating factor which shapes how System Flexibility, Perceived Security, and Ease of Use influence CHISA according to the presented table. DL x SF has an effect size of 0.183 and considerable statistical power with t = 6.106 and p = 0.000 on CHISA adoption. Digital literacy makes system flexibility more effective for adoption among users. The relationship between System Flexibility and CHISA adoption becomes more beneficial to users who possess proficient digital skills.

Research has established Digital Literacy as a significant moderator between Perceived Security (DL x PS) and CHISA based on measures of path coefficient 0.190 and both t-statistic and p-value at 7.332 and 0.000. Users who possess better digital skills demonstrate increased adoption propensity toward CHISA by identifying and appreciating its security features. The evaluation of Digital Literacy's moderating impact on Ease of Use (DL x EOU) and CHISA endorses significance because it presents a path coefficient of 0.220 and both a t-statistic of 6.643 along with a p-value at 0.000. Digital literacy intensifies ease of use as a factor for adopting CHISA according to the research findings. People who have advanced digital literacy skills make the system usage even simpler while their willingness to adopt the system stays strong.

Table 6
Path Analysis

	Beta	STDEV	T statistics	P values
DL -> CHISA	0.304	0.048	6.313	0.000
EOU -> CHISA	0.183	0.042	4.327	0.000
PS -> CHISA	0.429	0.027	16.130	0.000
SF -> CHISA	0.225	0.039	5.723	0.000
DL x SF -> CHISA	0.183	0.030	6.106	0.000
DL x PS -> CHISA	0.190	0.026	7.332	0.000
DL x EOU -> CHISA	0.220	0.033	6.643	0.000

4.7. Structural Model

The model structure (figure 3) identifies all latent variables within the study with direct and moderation effects that influence the adoption of CHISA (Cloud-Based Hospital Information System Adoption). The blue symbols within the structural model stand for latent constructs which include System Flexibility (SF), Ease of Use (EOU), Perceived Security (PS) and Digital Literacy (DL) together with CHISA Adoption. Each observed indicator has its corresponding yellow box in this representation. The framework displays path coefficient numbers on arrows alongside parentheses containing p-values to verify significance levels between these constructs.

This model displays Perceived Security (PS) as showing the most influential direct impact on CHISA adoption through a path coefficient of 0.429 accompanied by a p-value of

0.000 that verifies its high statistical significance. The assessment of security by users grows proportionally with the adoption rate of new systems. CHISA adoption gets enhanced when system developers focus on flexibility features and ease of use because these elements demonstrate significant impact with coefficients of 0.225 and 0.183.

Digital Literacy functions as a mediating factor in the model by affecting the connection strengths between System Flexibility and Perceived Security and Ease of Use with CHISA adoption. The moderation effects are all statistically significant, with Digital Literacy strengthening the effects of System Flexibility (0.183, p = 0.000), Perceived Security (0.190, p = 0.000), and Ease of Use (0.220, p = 0.000) on CHISA adoption. This indicates that healthcare professionals with higher digital literacy find flexible, secure, and user-friendly systems more beneficial, leading to greater adoption.

The R^2 value for CHISA adoption is 0.685, meaning that 68.5% of the variance in CHISA adoption is explained by the independent variables in the model. This indicates a strong explanatory power of the proposed framework.

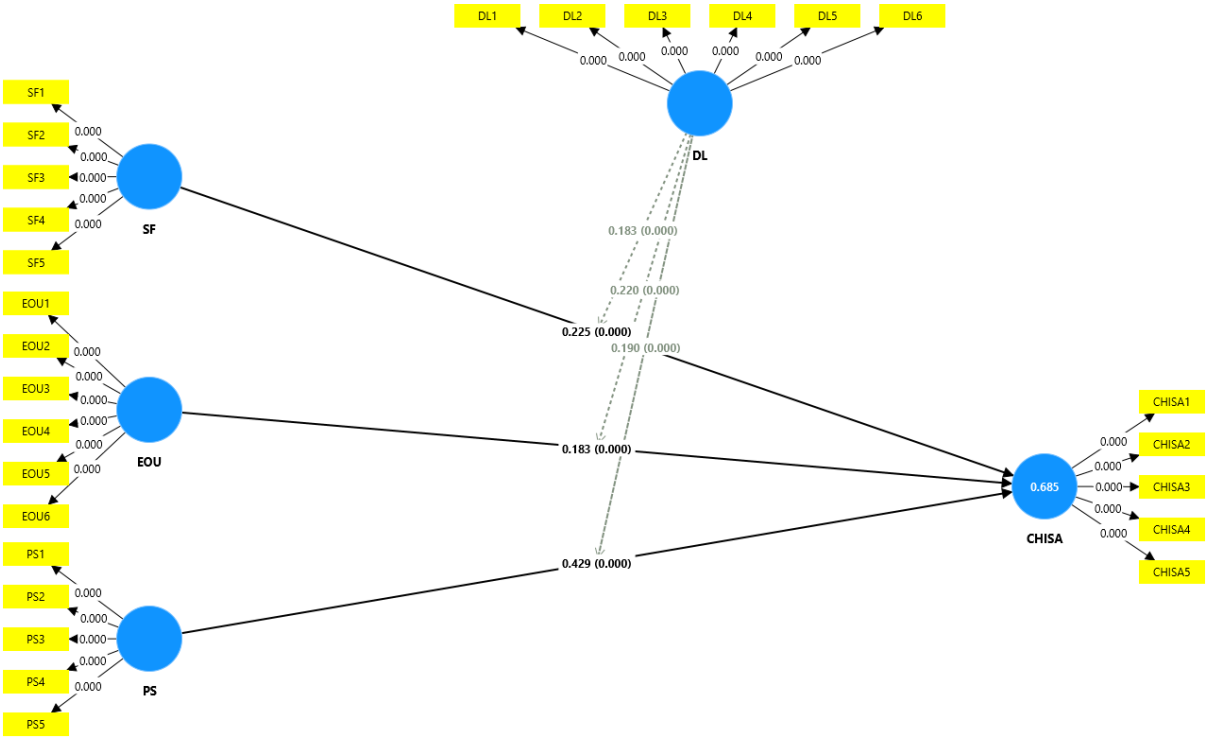

Figure 3: Structural Model

4.8. Discussion

This research generates significant knowledge about what determines Chinese healthcare organizations to adopt cloud-based hospital information systems. The study validates research from both healthcare technology acceptance fields and information system domains.

System flexibility proves to have a positive influence on the adoption of CHIS according to study findings. Research by Ahmed et al. (2020) demonstrates that healthcare professionals prefer adaptable systems because they accept them better. Hospitals deal with constant workflow and regulatory changes so flexible CHIS represents an essential requirement for these institutions (Al-Okaily, 2024). According to Al-Qerem et al. (2025) research demonstrates that fixed system structures produce user opposition but user-configurable systems establish better satisfaction together with increased usability. The purchase of interoperable and scalable CHIS solutions serves Healthcare institutions because such solutions can help them reach their objectives regarding usability and integration. The research results support existing studies which demonstrate ease of use represents a key criterion for CHIS system adoption (Dajani, Yaseen, Qirem, et al., 2022). Healthcare staff develop resistance and frustration when work requirements are complicated by systems that

need extensive training (Hung et al., 2023). A combination of user-intuitive systems and seamless interfaces and easy-to-follow navigation routes makes healthcare professionals more likely to adopt new technologies per research findings (Leong et al., 2017). The study data suggests hospitals should dedicate resources toward improving CHIS user interface designs and implementing full patient and staff instructional programs to enhance adoption rates of the system.

The level of perceived security remains the core element that influences healthcare information systems acceptance across the population. The risks surrounding healthcare data security prevent people from approving new system implementation (Mustafa et al., 2022). User decision-making to adopt technology heavily relies on their trust in system security as established through various research studies (Al-Somali et al., 2024a). The system will be adopted when users feel secure due to protected encryption methods and restricted accessibility together with regulatory compliance rules (Safdar et al., 2022). The research establishes improved security technologies together with enhanced security policy clarity acts as a fundamental element that drives more widespread use of CHIS systems. Healthcare institutions made CHIS adoption decisions based on their ability to understand digital technologies according to research findings. Strong digital skills among professional healthcare workers lead them toward CHIS adoption because of established research regarding technology acceptance (Junaedi et al., 2024). The capability to understand digital technology produces comfortable relationships with state-of-the-art digital tools which simplify complex devices and enhance CHIS system perceived advantages (Babalola et al., 2024). To boost their acceptance of healthcare technology both professional medical workers need continuous training and mandatory digital competency education.

The study makes an important discovery by showing that digital literacy acts as a mediator which affects the connection between system flexibility, ease of use, perceived security and CHIS adoption. CHIS acceptance enables better benefit utilization because users who display enhanced digital literacy skills gain optimal advantages from these systems according to Naamati-Schneider and Alt (2024). The discovery tracks previous research about how technology expertise boosts user comfort with digital implementations (Kar, 2021). Users who demonstrate advanced digital abilities possess the ability to effectively evaluate security measures and understand both system operations and implement Clinical Health Information Systems (CHIS) into their routines (Naamati-Schneider & Alt, 2024). Medical facilities must establish digital literacy education programs that enable their entire staff to use CHIS efficiently.

5. CONCLUSION

A Chinese research analysis evaluated what drives hospitals to adopt CHIS through examinations of system flexibility combined with ease of use and perceived security and digital literacy. Digital literacy functions as a vital contingency element which strengthens the effects of system flexibility together with ease of use and perceived security on CHIS adoption processes. The study establishes important conclusions which strengthen healthcare technology adoption research and deliver practical recommendations to both healthcare facilities and technology suppliers and government officials.

5.1. Theoretical Implications

This research expands the Technology Acceptance Model (TAM) along with the Unified Theory of Acceptance and Use of Technology (UTAUT) by introducing digital literacy as an important moderation factor for CHIS acceptance. The study makes clear that patients' technological abilities stand as crucial determinants for achieving successful outcomes from hospital information systems. The research demonstrates how digital literacy increases the effectiveness of system attributes in the adoption process which leads to better understanding of technology skills in healthcare digital transformations. Research models for hospital technology adoption in future should identify digital skills training as fundamental elements which determine system acceptance.

5.2. Practical Implications

Healthcare facilities should focus on usability and security alongside flexibility of CHIS to achieve seamless integration into existing hospital operational systems. Healthcare organizations need to build user-friendly adaptable computer systems which serve all spectrum of medical staff requirements. Security must undergo enhancement to achieve user trust which meets both user trust requirements and data protection regulations. Hospital institutions need to commit their resources to develop training initiatives that boost digital skills across their personnel base since digital literacy proves essential for such development. Hospitals will achieve their best performance through cloud-based systems for patient care improvement through policymaker backing of digital literacy programs. Hospital administration must complement cloud-based system implementation with leadership-supported training and collective learning practices, as learning communities can improve staff capability and readiness for organizational change (Abdulla et al., 2022).

5.3. Policy Suggestions

Largescale implementation of CHIS systems needs government agencies together with healthcare regulators to develop compelling policies which support cloud-based system adoption. Government assistance for CHIS system implementation will provide financial resources along with tax advantages for CHIS hospitals and requirements regarding security and usability. Healthcare employees need regular training programs and digital competence evaluation methods under official policies to enhance their ability to benefit from CHIS system features.

5.4. Directions for Future Research

The research findings in this study generate vital knowledge but future research needs to develop specific directions. Researchers need to conduct long-term studies to study CHIS adoption patterns throughout the system usage period because user perception changes over time. Research spread across different medical systems within various countries offers expanded perceptions about the external influences which affect CHIS implementation. Future research needs to analyze how organizational cultures together with leader backing and employee resistance impact CHIS implementation processes. Additional information about CHIS adoption challenges and enablers can be obtained through qualitative research methods which include talking to healthcare professionals.

Author Contributions

Muhammad Azhar Bhatti: Led the conceptualization, methodology development, data analysis, and preparation of the original manuscript.
Tusawar Iftikhar Ahmad: Led the research supervision, data interpretation, critical review, and final editing of the manuscript.
Amina Alamgir: Contributed to the literature review, data collection, and preparation of the initial draft.
Samar Abbas: Assisted with data collection, analysis, manuscript revision, and formatting of the final paper.

Conflict of Interests/Disclosures

The authors declared no potential conflicts of interest w.r.t the research, authorship and/or publication of this article.

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Appendix

Construct	Items
System Flexibility (Goodhue, 1995)	1. I find the computer systems providing data access both easy to operate and highly convenient. 2. The information maintained by the corporation precisely addresses the requirements for my work tasks. 3. I find it simple to obtain the needed data. 4. Any definition about data fields associated with my tasks can easily be discovered. 5. I can get help from the system when I struggle to locate and operate data within its database.
Ease of Use (Venkatesh & Davis, 2000)	1. Operating this system would seem straightforward to me regarding learning. 2. The system would easily let me achieve my desired functions. 3. The system interface would display logical processes that are clear to understand. 4. The system presents adaptable functionality when users try to work with it. 5. Developing skillfulness in system operation represents a simple challenge for me. 6. Using this system would prove straightforward for me.
Perceived Security (Chiu et al., 2009)	1. Users can interact easily with this system. 2. The technical system gives me an understandable interface to work with. 3. Users find it straightforward to develop their skills in operating the system. 4. Customers enjoy security within the system because it maintains the protection of their data. 5. The system maintains complete encryption security standards which protects user information.
Digital Literacy (Hargittai, 2005)	1. My self-rating of Internet skills. 2. My level of familiarity with Modem reaches to the extent. 3. I am familiar with what Browser entails. 4. My understanding of the Server reaches to. 5. I am aware about the workings of ISP. 6. My knowledge of HTML extends to.
System Adoption (Venkatesh et al., 2003)	1. The system functions help me to complete tasks in reduced amounts of time. 2. The system facilitates work quality to improve. 3. The system makes my work tasks simpler to perform. 4. The implementation of this system enables me to perform with higher efficiency at work. 5. The system enhances my productivity levels.