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A Secure Cloud Computing Infrastructure for Big Data Information Management

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ABSTRACT

Research into cloud computing integration in big data management needs thorough study of the dynamic organizational and technological relations that exist. This research analyzes the connections between Cloud Security Solutions (CSS) and Compliance Practices (CP) during Data Security Measures (DSM) in front of Organizational Readiness for Technology (ORT) and Big Data Decision-Making Capability (BDDMC) before Big Data Information Management Effectiveness (BDIME). This research aims to determine how Chinese cloud computing enterprises use CSS, CP, DSM and ORT to develop BDDMC and BDIME. The research investigates ORT as it influences the relationship between primary variables and their connection to BDIME. Structural Equation Modeling (SEM) analyzed 450 responses obtained from Chinese enterprises through a quantitative research design. The researchers performed a validity check using convergent and discriminant validity measurement techniques and analyzed the proposed relationships by studying path analysis results. This research establishes that CMS together with ASM produce higher BDDMC which creates positive effects on BDIME. The Custody-Physical measure exerts direct positive effects on BDDMC as well as BDIME. ORT applies direct influences to BDIME and reinforces the impact of CSS, DSM and CP on BDIME such that they become more effective. The research proves that organizational readiness stands as an essential factor which optimizes the efficiency of both technological and compliance approaches in big data administration systems. The examination of security and compliance together with organizational readiness contributes to cloud computing and big data management literature by showing their primary impact on organizational decision-making abilities and information management success. Organizations that make strategic investments in such areas experience meaningful positive outcomes within their big data activities in cloud environments. Cloud computing in big data management requires practitioners to enhance security measures along with strict compliance adherence and organizational readiness improvement to maximize benefits.

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1. Introduction

Global business strategies continue shifting towards digital transformation where China stands as a leading country that implements cloud computing to achieve better big data management. The advancement gains special importance since China has a massive industrial sector combined with government backing for technology-based economic development. The implementation of cloud systems both improves business performance and brings difficulties regarding system expansion together with data protection and regulatory requirement

adherence. Organizations must recognize these factors because they determine the optimal setup of their cloud technologies and data management procedures within cloud-based platforms. The flexible computing environment of cloud technology remains essential to handle the handling of large heterogeneous enterprise data volumes that today's businesses produce. Businesses require the scalability feature because it permits them to reallocate resources efficiently during data peaks and valleys thus ensuring operational flexibility and affordability (Ahmad & Andras, 2019). According to S. Sharma and Chaturvedi (2021) cloud service scalability requires parallel optimization of performance to support persistent data-intensive application deployments. Juntunen, Ahokangas, and ... (2018) argue that cloud-based business models need scalable features because they must adjust to fast-changing market markets and consumer wants.

Cloud-based system migration triggers critical security complications because remote servers expose data to internet access-related vulnerabilities. D. Chen and Zhao (2012) point out data security along with privacy protection concerns in cloud computing as the primary obstacles slowing down adoption of cloud technologies. Kaufman (2009) describes these security issues in detail by noting that protecting cloud-based data necessitates both cutting-edge technology platforms as well as formal safety protocols. Organizations must comply with multiple regulations found in international and local environments which Langevoort (2017) and Mitchell (2014) discuss because operational legitimacy and legal compliance depend on this compliance. The transformation of decision-making processes came through big data analytics because organizations can extract strategic insights from large data quantities. Jumping to Awan, Shamim, Khan, Zia, Shariq, and ... (2021) researchers describe how big data systems create enhanced decision-making through data-based strategic knowledge which drives operational and business strategy development. Nisar, Nasir, Jamshed, Naz, and ... (2021) establish that organizations which effectively manage their big data achieve enhanced environmental performance as well as organizational success because of the broad-ranging effects big data has on business operations. Organizations using data processing abilities to generate useful insights from unprocessed information achieve better competitive performance as the global economy shifts toward data-driven operations. Business operations which integrate cloud computing and big data analytics must rely on an organization's readiness to embrace and use these sophisticated technologies effectively. According to A. Sharma and Venkatraman (2023) and (Lokuge, Sedera, Grover, & Dongming, 2019) organizations need to prepare multiple facets including advanced technology systems and worker training and encouraging workplace environments to succeed. Organizational readiness decides how well organizations utilize digital innovations to reach sustainable marketplace growth.

1.1. Research Objectives

The research foundation leads to the following four objectives:

1. There is a need to explore how cloud scalability solutions affect big data decision-making power in Chinese businesses.
2. An assessment of how data security systems affect decision-making performance using big data resources.
3. The research evaluates how organizational compliance procedures influence the decision-making power regarding big data.
4. An investigation evaluates how big data decision abilities function as a mediation factor between cloud infrastructure and information management operational success.
5. The analysis determines how preparedness within organizations toward technological adoption influences the connection between cloud computing capabilities and decision processes using big data.
6. The research investigates how decision-making abilities affect the performance of big data information management systems.

1.2. Significance of the Study

The study demonstrates its importance by exploring the complete picture of technological and organizational and regulatory factors which determine big data management in Chinese cloud environments. Business executives and IT managers will gain meaningful intelligence through these findings when making strategies for implementing cloud solutions and big data analytical programs. The study enhances academic knowledge by delivering empirical data about factor synergy which helps researchers develop theoretical insights while planning new investigation paths.

1.3. Scope and Research Gap

The research investigates cloud computing and big data management among different industrial sectors of Chinese businesses which span technology, finance, healthcare and manufacturing sectors. Empirical research which combines analysis of scalability together with security aspects and compliance standards and organizational preparedness for big data management remains limited despite substantial research into cloud computing and big data. This investigation targets the knowledge deficiency by delivering elaborate data about these phenomena from China's rapidly advancing digital realm. Cloud computing and big data analytics transformed business operations by presenting organizations with fresh prospects to expand and advance their operations. This investigation strives to advance knowledge about the combined impact of cloud scalability and data security and compliance procedures and organizational readiness on big data management systems for Chinese enterprises. The analysis of these points will boost theoretical settings along with generating practical recommendations to optimize cloud methods and data controls for businesses. This study presents essential contributions that match the growing need of businesses and economies to use digital technologies for their operations and competitive strategies.

2. Literature Review

2.1. Cloud Scalability Solutions

Cloud computing scalability stands essential for businesses dealing with large datasets characteristic of big data operations. Brataas, Herbst, Ivansek, and Polutnik (2017) describe scalability as an operational system ability to process higher loads efficiently throughout its entire scope of functionality. The system needs this functionality to preserve its operational strength and response speed across different usage levels. The essential part of resource allocation algorithms gets evaluation by Fadnavis, Patil, Padyana, Rai, and Ogeti (2021) as these algorithms improve the distribution and utilization of computing resources to minimize bottlenecks and boost system performance. The system faces unpredictable and massive data loads which require suitable management as addressed by S. Sharma and Chaturvedi (2021) in their study. According to Zhong, Chen, Dan, and Rezaeipanah (2022) elastic computing resources create a mechanism to dynamically adjust available resources for meeting changing real-time requirements. Our initial research hypothesis number 1 (H1) demonstrated that cloud scalability features enhance big data decision practices since a scalable cloud framework is vital for reliable data operations.

2.2. Data Security Measures

The protection of data stored in cloud environments remains essential because cyber-attacks and data breaches occur habitually. J. Chen, Ramanathan, and Alazab (2021) present advanced encryption methodologies which safeguard both resting and transit data through advanced encryption methods that protect information from unauthorized access. Sulistio (2023) argues that strong access control systems operate as the essential early barrier preventing unauthorized personnel from accessing protected information. Alraja, Butt, and Abbod (2023) indicate security audits serve an essential function for system vulnerability detection allowing fast response before attackers exploit the cloud infrastructure according to their findings. Effective data security practices will enhance organizational ability to conduct decision-making activities based on secure reliable information according to research hypothesis 2 (H2).

2.3. Compliance Practices

Big data management under cloud computing requires organizations to follow the complex set of legal and regulatory requirements. Alraja, Butt, and Abbod (2023) point out the necessity of GDPR compliance because these data protection regulations determine both privacy safeguards and secure ways of handling user information. The research conducted by Kim and Kim (2017) shows that businesses need compliance training to teach staff about regulations which reduces the likelihood of breaking compliance rules with severe penalties. The third research hypothesis (H3) demonstrates how compliance practices build better big data decision capabilities through appropriate legal and moral data management requirements.

2.4. Organizational Readiness for Technology

An organization that shows preparedness in adopting new technology achieves better results when exploiting these technologies in productive ways. According to Esen and Özbağ (2014) organizations require both technological readiness and ready employees to implement new solutions properly. The sustainable integration of long-term innovation and technology

depends heavily on organizations with cultures dedicated to ongoing technological learning and adaptation according to Lokuge et al. (2019). According to Hypotheses 5a, 5b, and 5c higher organizational readiness serves to amplify the positive relationship between cloud scalability solutions and data security measures and compliance practices which enhances big data decision-making capability.

2.5. Big Data Decision-Making Capabilities and Information Management Effectiveness

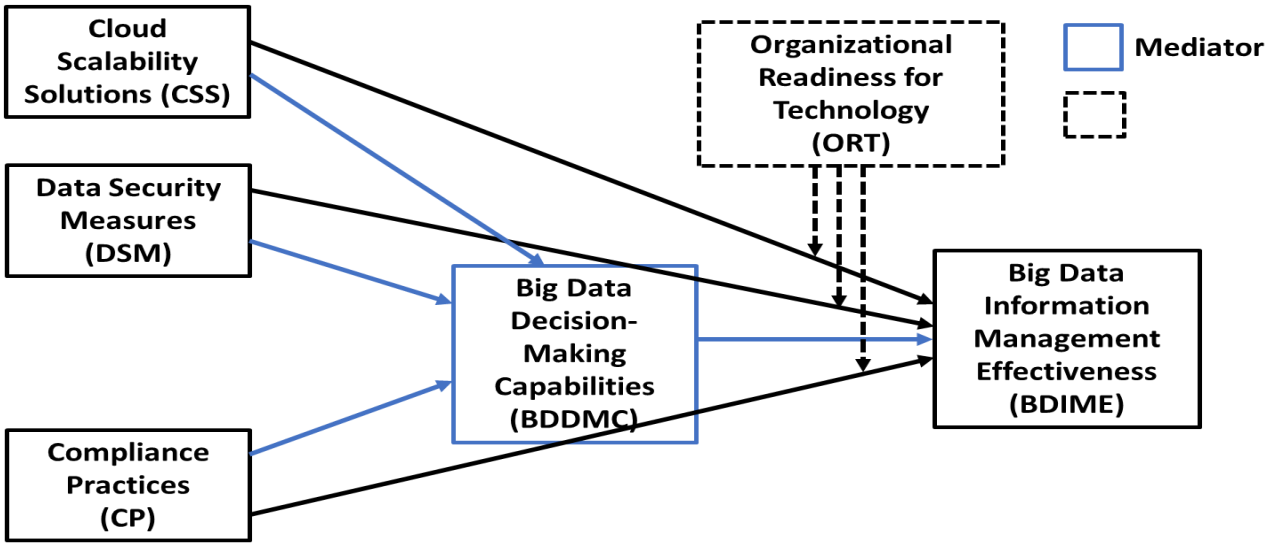
The fundamental principle of big data involves making precise decisive decisions at the right time for strategic advantages. Shamim, Zeng, Shariq, and Khan (2019) explain that big data decision-making capabilities combine multiple data sources with analytical tools to build precise strategic insights through better decisions. Big data management effectiveness depends on obtaining accurate data analyses findings because this produces actionable insights needed for strategic planning processes. Hypotheses 4 and 6 demonstrate the connection between overall big data information management effectiveness and cloud infrastructure capabilities through the intermediate role of decision-making capabilities. In this review of literature researchers establish how cloud scalability together with data security and compliance practices alongside organizational readiness build organization capabilities to effectively manage big data inside cloud environments. The research explores direct and indirect associations between these elements to develop an in-depth comprehension of organizational big data management success and technological deployment effectiveness. The complete study confirms the hypothesized relationships and paves the way for empirical research that will test these relationships through secure cloud infrastructure for big data information systems.

Table 1: Literature Review Matrix

Author(s)	Year	Key Focus	Methodology	Main Findings	Relevance to Big Data Management
(Alraja, Butt, & Abbod, 2023)	2023	Information security policy compliance	PLS-SEM	Evaluated the role of motivation theory on policy compliance in banks	Highlights the importance of security policies in managing big data
(Ponnusamy et al., 2021)	2021	IoT in big data management	Case study	Reviewed the integration of IoT technologies in smart grids	Demonstrates the integration of IoT with big data in cloud environments
(Zhong et al., 2022)	2022	Big data management in IoT	Experimental	Developed TinyML algorithms for better data handling in IoT systems	Innovations in data processing and management in cloud settings
(Naghib, Jafari Navimipour, Hosseinzadeh, & Sharifi, 2023)	2023	Big data management in IoT	Systematic review	Reviewed modern big data management techniques in IoT	Pertinent to enhancing big data management strategies in cloud systems
(Sulistio, 2023)	2023	Cybersecurity effectiveness	PLS-SEM	Assessed factors influencing cybersecurity in organizations	Critical for secure and effective big data management in the cloud
(Bai & Bai, 2021)	2021	Sports big data analysis	Review	Explored management and applications of sports data	Shows sector-specific applications of big data in cloud environments
(J. Chen, Ramanathan, & Alazab, 2021)	2021	AI for smart cities	Conceptual	Proposed AI models to enhance data privacy and	Relates to secure data management within cloud-based big data frameworks

				security in smart cities	
(Fadnavis et al., 2021)	2021	Cloud scalability and performance	Review	Discussed strategies for optimizing cloud service performance	Essential for effective big data management in cloud infrastructures
(S. Sharma & Chaturvedi, 2021)	2021	Scalability in cloud services	Conceptual	Proposed solutions for cloud scalability issues	Directly applicable to managing large-scale big data systems
(Thi-Duong & Ke-Duc, 2021)	2021	Security in e-payment systems	PLS-SEM	Measured the impact of security on user trust in e-payments	Highlights security aspects vital for big data transactions in cloud environments
(Lokuge et al., 2019)	2019	Readiness for digital innovation	Mixed methods	Developed a construct for assessing organizational readiness for digital innovations	Relates to preparing organizations for big data initiatives
(Shamim et al., 2019)	2019	Big data decision-making	Survey	Investigated how big data management influences decision-making capabilities	Core to understanding decision-making in cloud-based big data scenarios
(Shamim, Cang, & Yu, 2019)	2019	Knowledge management in big data	Survey	Role of knowledge management in enhancing big data capabilities	Applies to knowledge-driven big data operations in cloud environments
(Brataas et al., 2017)	2017	Scalability of cloud services	Experimental	Analyzed scalability issues in cloud software services	Direct relevance to managing scalability in big data applications
(Kim & Kim, 2017)	2017	Compliance in IT	Survey	Explored the impact of knowledge management on compliance behavior	Connects compliance and data governance in cloud-based systems
(Subramaniama, Shamsudinb, & Alshuaibic, 2017)	2017	Workplace safety and compliance	SEM	Explored the relationship between safety perceptions and compliance	Indirectly relevant to data security and regulatory compliance in big data
(Wraikat, Bellamy, & Tang, 2017)	2017	Organizational readiness for technology	Case study	Examined readiness factors for new technology implementation in nonprofits	Offers insights on readiness for deploying big data solutions
(Esen & Özbağ, 2014)	2014	Organizational readiness for e-HRM	Survey	Investigated the effects of readiness on technology acceptance	Highlights organizational aspects affecting big data implementations
(Snyder-Halpern, 2001)	2001	Organizational readiness for IT	Delphi study	Assessed readiness for clinical IT innovations	Provides insights into organizational preparation for big data projects

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



3. Data And Methodology

3.1. Research Design

This quantitative study investigates how cloud scalability solutions similar to data security mechanisms and compliance practices affect both big data decision-making competence and big data information management success. The main mediator of this research study is big data's ability to make decisions while organizational readiness for technology acts as the moderator. This study obtains data through a cross-sectional survey approach to establish a temporary overview of variable relationships within single-time observations of secure cloud computing systems of potential respondents.

3.2. Population and Sampling

The intended participants for this research are both IT professionals and management personnel working in Chinese enterprises that currently use cloud computing to handle big data requirements. The researchers have selected this group because its members understand both the processes and technologies being studied. A sample of 450 subjects was acquired across technology and finance along with healthcare and manufacturing sectors to gain various perspectives about cloud adoption and its effects. The research uses convenience sampling to recruit participants by focusing on obtaining diverse organizations that utilize advanced cloud-based and big-data solutions.

3.3. Data Collection Method

A survey is distributed online to participants using professional networking platform LinkedIn and email to obtain their responses. The survey instrument contains structured questions employing a Likert scale with response options ranging between 1 (Strongly Disagree) through 5 (Strongly Agree) to evaluate survey participants' perceptions about cloud scalability, security, compliance and business decision-making ability and information management effectiveness. A small number of survey respondents evaluates the survey prior to distribution to confirm both the clarity and question reliability.

3.4. Measurement of Variables

The research utilizes multiple survey items which stem from literature to measure each study construct.

1. The measurement instruments employ four items to assess cloud scalability solutions whereas they focus predominantly on resource scalability and performance efficiency elements.
2. The three components of data security measures involve encryption solutions together with access controls in combination with scheduled security audits.
3. A scaling process identifies compliance practices by testing three measures that analyze data protection regulations as well as compliance training procedures.

4. The evaluation of big data decision-making abilities includes four parameters that demonstrate data analytics integration as well as strategic decision optimization.
5. User satisfaction serves with accuracy and timeliness as the three key items to assess big data information management effectiveness.
6. The three performance indicators of organizational technology readiness evaluate both infrastructure readiness and employee preparedness with support from organizational cultural values.

Table 2: Constructs and Items

Construct	Item Description	Citation
Cloud Scalability Solutions (IV)	1. The system requires capabilities for real-time modification of computing resources according to current data demand patterns. 2. Efficiency of resource allocation algorithms in cloud environments. 3. A system must have capabilities to handle surge data loads while maintaining operation stability. 4. The system includes elastic resource integration to achieve better performance optimization.	Brataas et al. (2017) Fadnavis et al. (2021) Sharma & Chaturvedi (2021) (Zhong et al., 2022)
Data Security Measures (IV)	1. The implementation process includes advanced data encryption methods for both data storage and its transmission. 2. Companies must deploy strong access control systems that stop unauthorized individuals from entering the system. 3. The organization uses periodic security audits that help find and resolve system weaknesses.	Chen et al. (2021) Sulistio (2023)
Compliance Practices (IV)	1. Compliance with international data protection regulations such as GDPR. 2. The organization should introduce employee compliance training programs. 3. The organization needs to update compliance policies through regular maintenance which reflects new regulations.	Kim & Kim (2017)
Big Data Decision-Making Capabilities (Mediator)	1. Organizations should merge different types of data sources for better strategic choice accuracy. 2. Predictive analytics systems should provide data which helps strategic decision making. 3. Adoption of decision support systems that leverage real-time data. 4. The system demonstrates ability to convert meaningful big data information into strategic operational plans.	Shamim et al. (2019) Shamim et al. (2019)
Big Data Information Management Effectiveness (DV)	1. The accuracy level which emerges from analyzing big data information. 2. The system must deliver operational data promptly after its retrieval and subsequent processing. 3. User satisfaction with the information management system.	Shamim et al. (2019) Shamim et al. (2019) Bai & Bai (2021)
Organizational Readiness for Technology (Moderator)	1. Technical readiness of infrastructure to operate new system platforms. 2. Staff members both understand and accept new technological systems within their organization. 3. Organizational culture's support for continuous technological learning and adaptation.	Esen & Özbağ (2014); Lokuge et al. (2019)

3.5. Data Analysis Technique

A structural equation modeling analysis is performed through Smart-PLS (partial least squares) software for the data analysis. The research selects this method because it efficiently manages complicated model structures while working with small to medium sample sizes which enables evaluation of both direct and indirect relationships between independent variables and dependent variables involving mediators and another evaluation of organizational readiness as a moderator.

3.6. Ethical Considerations

For ethical research practices the study informs participants about both the purpose and response confidentiality standards. Every respondent receives clear informed consent before participating along with confirmation that their involvement is both voluntary and free from any consequence of early withdraw. The study meets all legal requirements related to privacy regulations for both data protection and management processes. Research gains ethical permission for this study from the institutional review board which operates at the hosting academic institution.

4. Results

Results of the convergent validity (table 3) assessment for different constructs of this study appear in an organized table which examines big data management and security systems in cloud computing environments. The analyzed constructs in this study consist of Big Data Decision-Making Capability (BDDMC), Big Data Information Management Effectiveness (BDIME), Compliance Practices (CP), Cloud Security Solutions (CSS), Data Security Measures (DSM) and Organizational Readiness for Technology (ORT). The metric reliability indicators for BDDMC indicate that items share strong connections with the construct through values between 0.761 and 0.82. Reliability tests demonstrate excellent internal consistency between the constructs due to the Cronbach's Alpha value of 0.801 and Composite Reliability (CR) of 0.87. A good level of convergent validity is established through the Average Variance Extracted (AVE) value which shows 0.626 that the construct itself explains most of the items' variance. The item loadings for BDIME range from 0.786 to 0.827 thus showing solid proof that the construct items represent the construct well. Good reliability measures emerge from the Cronbach's Alpha value of 0.74 as well as from the CR value of 0.852. An Average Variance Extracted value of 0.658 surpasses 0.5 which confirms strong convergent validity because this figure demonstrates that below 50% of items' variance stems from BDIME construct influences.

The CP construct displays item loadings from 0.8 to 0.838. With a Cronbach's Alpha of 0.766 and a CR of 0.864, the construct shows high internal consistency. The AVE for CP is 0.68, which is well above the desirable level, confirming that most of the variance in these items is due to the construct itself. CSS items have loadings ranging from 0.753 to 0.841, and while one item slightly dips below the preferred minimum of 0.8, it still remains acceptable. The construct has a Cronbach's Alpha of 0.826 and a CR of 0.885, both indicative of very good internal consistency and reliability. The AVE is 0.658, indicating robust convergent validity. For DSM, the item loadings are between 0.791 and 0.847, demonstrating a strong linkage to the construct. The construct's Cronbach's Alpha and CR are 0.746 and 0.854, respectively, both showing good reliability. The majority of variance in items derives from the DSM construct based on the estimation of 0.662 AVE. The item loadings of the ORT variable range between 0.805 and 0.879 which demonstrates a strong relationship to its construct. Both the Cronbach's Alpha value of 0.788 and the CR value of 0.874 indicate good reliability scores. With an AVE of 0.699, ORT shows excellent convergent validity, with most variance in the items due to the construct. The provided numerical data validates the construct validity which continues to show strength across the current study's research environment. The measures used in this research show solid internal consistency along with reliability as well as explanatory power for the construct making them suitable for analysis relating to cloud computing big data management and security in Chinese enterprises.

Table 3: Convergent Validity Test

Constructs	items	Loading	Alpha	CR	AVE
BDDMC	BDDMC1	0.793	0.801	0.87	0.626
	BDDMC2	0.791			
	BDDMC3	0.82			
	BDDMC4	0.761			
BDIME	BDIME1	0.819	0.74	0.852	0.658
	BDIME2	0.827			
	BDIME3	0.786			
CP	CP1	0.8	0.766	0.864	0.68
	CP2	0.838			
	CP3	0.835			
CSS	CSS1	0.841	0.826	0.885	0.658
	CSS2	0.753			
	CSS3	0.816			
	CSS4	0.831			

DSM	DSM1	0.791	0.746	0.854	0.662
	DSM2	0.801			
	DSM3	0.847			
ORT	ORT1	0.822	0.788	0.874	0.699
	ORT2	0.879			
	ORT3	0.805			

The Structural Equation Model utilizes the Heterotrait-Monotrait (HTMT) ratio (presented in the table 4) for validating the discriminant validity of its constructs. The purpose of discriminant validity assessment is to confirm two variables have no correlations when they should be distinct. A robust model shows HTMT ratios below 1.0 where values must remain below .90 or lower based on assessment criteria standards. This section presents an interpretation of the HTMT ratios that evaluate construct relationships in the model. The HTMT ratio is 0.805. The calculated value (0.805) indicates moderate levels of correlation between Big Data Decision-Making Capability (BDDMC) and Big Data Information Management Effectiveness (BDIME) even though it remains below the strict threshold of 0.90. Under standard research terms the strong association between Big Data Decision-Making Capability (BDDMC) and Big Data Information Management Effectiveness (BDIME) meets the required standards for discriminating validity. Data derived from the HTMT analysis reveals distinct measurements of Big Data Decision-Making Capability (BDDMC) versus Compliance Practices (CP) because their ratio of 0.516 exceeds thresholds. The two dimensions operate independently of one another since they measure different entities. The discriminant validity between Big Data Decision-Making Capability (BDDMC) and Cloud Security Solutions (CSS) is present because their HTMT ratio stands at 0.613. Strong discriminative capabilities exist between Data Security Measures (DSM) and Big Data Decision-Making Capability (BDDMC) because their ratio stands at 0.447.

The Organizational Readiness for Technology (ORT) and BDDMC constructs demonstrate extremely distinct relationship according to their very low HTMT ratio of 0.097 which indicates strong discriminant validity. Discriminant validity between Big Data Information Management Effectiveness (BDIME) and Compliance Practices (CP) remains good due to an HTMT ratio which stands at 0.513. BDIME demonstrates excellent distinctiveness from Cloud Security Solutions (CSS) based on the 0.39 ratio. The discriminant validity between BDIME and Data Security Measures (DSM) stands firm because their HTMT score equals 0.405. The observed HTMT ratio value of 0.388 demonstrates strong evidence that the constructs represent separate concepts to users. The extremely strong discriminant validity emerges between Compliance Practices (CP) and Cloud Security Solutions (CSS) because their HTMT ratio stands at 0.079. The discriminant validity between Compliance Practices (CP) and Data Security Measures (DSM) exists at a strong level based on the HTMT ratio of 0.124. An HTMT ratio of 0.117 shows strong discriminant validity between Compliance Practices (CP) and Organizational Readiness for Technology (ORT). Strong discriminant validity exists between Cloud Security Solutions (CSS) and Data Security Measures (DSM) when using the HTMT ratio of 0.115. Very strong discriminant validity exists when constructs show a 0.069 HTMT ratio because such numbers indicate distinct perceptual differences between these constructs. The discriminatory separation strength between Organizational Readiness for Technology (ORT) and Data Security Measures (DSM) appears through their HTMT ratio of 0.099. Overall, these results indicate that all pairs of constructs maintain discriminant validity, as all HTMT ratios are below the typical threshold of 0.90, with many significantly lower. This reinforces the appropriateness of the construct definitions and the measurement model used in the study, ensuring that each construct captures unique aspects of the phenomenon under investigation.

Table 4: HTMT Ratio

	BDDMC	BDIME	CP	CSS	DSM	ORT
BDDMC						
BDIME	0.805					
CP	0.516	0.513				
CSS	0.613	0.39	0.079			
DSM	0.447	0.405	0.124	0.115		
ORT	0.097	0.388	0.117	0.069	0.099	

The Fornell-Larcker (table 5) is used to assess discriminant validity by comparing the square root of the Average Variance Extracted (AVE) for each construct against the correlations

between constructs. This approach helps to ensure that constructs within a model are distinct from one another, which is a crucial aspect of establishing the reliability and validity of measurement in a research study. For BDDMC the diagonal value is 0.791. It is greater than all its corresponding correlations with other constructs (0.623 with BDIME, 0.405 with CP, 0.501 with CSS, 0.349 with DSM, and -0.014 with ORT), confirming discriminant validity. For BDIME the diagonal value is 0.811. It surpasses all its correlations with other constructs (0.623 with BDDMC, 0.395 with CP, 0.308 with CSS, 0.306 with DSM, and 0.302 with ORT), supporting discriminant validity. For Compliance Practices the diagonal value is 0.824, which is higher than all its correlations with other constructs (0.405 with BDDMC, 0.395 with BDIME, 0.063 with CSS, 0.031 with DSM, and 0.015 with ORT), indicating strong discriminant validity. For Cloud Security Solutions the diagonal value is 0.811. This value is higher than its correlation coefficients with other constructs (0.501 with BDDMC, 0.308 with BDIME, 0.063 with CP, -0.087 with DSM, and 0.014 with ORT), confirming discriminant validity.

For DSM the diagonal value is 0.813. It exceeds all its correlation values with other constructs (0.349 with BDDMC, 0.306 with BDIME, 0.031 with CP, -0.087 with CSS, and -0.072 with ORT), ensuring discriminant validity. For Organizational Readiness for Technology the diagonal value is 0.836, which is higher than all its correlation values with other constructs (-0.014 with BDDMC, 0.302 with BDIME, 0.015 with CP, 0.014 with CSS, and -0.072 with DSM), demonstrating strong discriminant validity. The Fornell-Larcker criterion is satisfied for all constructs in the model, as demonstrated by the diagonal AVE values being larger than the off-diagonal correlation values for all pairs of constructs. This result confirms that each construct is distinct and shares more variance with its indicators than with other constructs in the model, providing strong evidence of discriminant validity in the study's measurement model. This robust discriminant validity is crucial for ensuring the reliability and accuracy of the constructs within the context of this research on cloud computing and big data management in China.

Table 5: Fornell Larcker

	BDDMC	BDIME	CP	CSS	DSM	ORT
BDDMC	0.791					
BDIME	0.623	0.811				
CP	0.405	0.395	0.824			
CSS	0.501	0.308	0.063	0.811		
DSM	0.349	0.306	0.031	-0.087	0.813	
ORT	-0.014	0.302	0.015	0.014	-0.072	0.836

The cross loadings in table 6 provide data to evaluate discriminant validity by showing how each item (indicator) loads on its own construct (intended construct) in comparison to how it loads on other constructs in the model. The criterion for adequate discriminant validity is that an item should load higher on its own construct than on any other construct in the model. Items BDDMC1, BDDMC2, BDDMC3, and BDDMC4 of the construct Big Data Decision-Making Capability all load highest on their own construct (ranging from 0.761 to 0.82) compared to their loadings on other constructs (ranging from -0.02 to 0.531), demonstrating good discriminant validity for the BDDMC construct. Items BDIME1, BDIME2, and BDIME3 of the construct Big Data Information Management Effectiveness exhibit highest loadings on their own construct (ranging from 0.786 to 0.827) and lower on other constructs (maximum cross-loadings ranging from 0.518 to 0.547 on BDDMC), confirming discriminant validity for BDIME. The items CP1, CP2, and CP3 of the construct Compliance Practices show significantly higher loadings on the CP construct (0.8, 0.838, 0.835 respectively) compared to their loadings on other constructs (maximum cross-loadings of 0.359, 0.367, and 0.367 respectively on BDDMC), supporting discriminant validity. The items CSS1, CSS2, CSS3, and CSS4 of the construct Cloud Security Solutions load distinctly higher on CSS (ranging from 0.753 to 0.841) compared to their loadings on other constructs (maximum cross-loadings of 0.441 on BDDMC), which evidences strong discriminant validity.

The items DSM1, DSM2, and DSM3 of the construct Data Security Measures load substantially higher on DSM (0.791, 0.801, 0.847 respectively) than on other constructs (maximum cross-loadings of 0.321 on BDDMC), affirming discriminant validity. The items ORT1, ORT2, and ORT3 of the construct Organizational Readiness for Technology clearly demonstrate higher loadings on their own construct (0.822, 0.879, 0.805 respectively) compared to cross-loadings (maximum cross-loadings of 0.306 on BDIME for ORT2), confirming discriminant validity. The analysis of the cross loadings table successfully demonstrates that each item loads significantly higher on its own construct than on any other construct, confirming discriminant

validity across all constructs. This result is crucial for the integrity of the measurement model as it ensures that each construct is distinctly measured by its indicators, without significant overlap with measurements of other constructs. This clear differentiation supports the reliability and validity of the constructs used in the study, providing a solid foundation for the analysis of relationships within the structural model.

Table 6: Cross Loadings

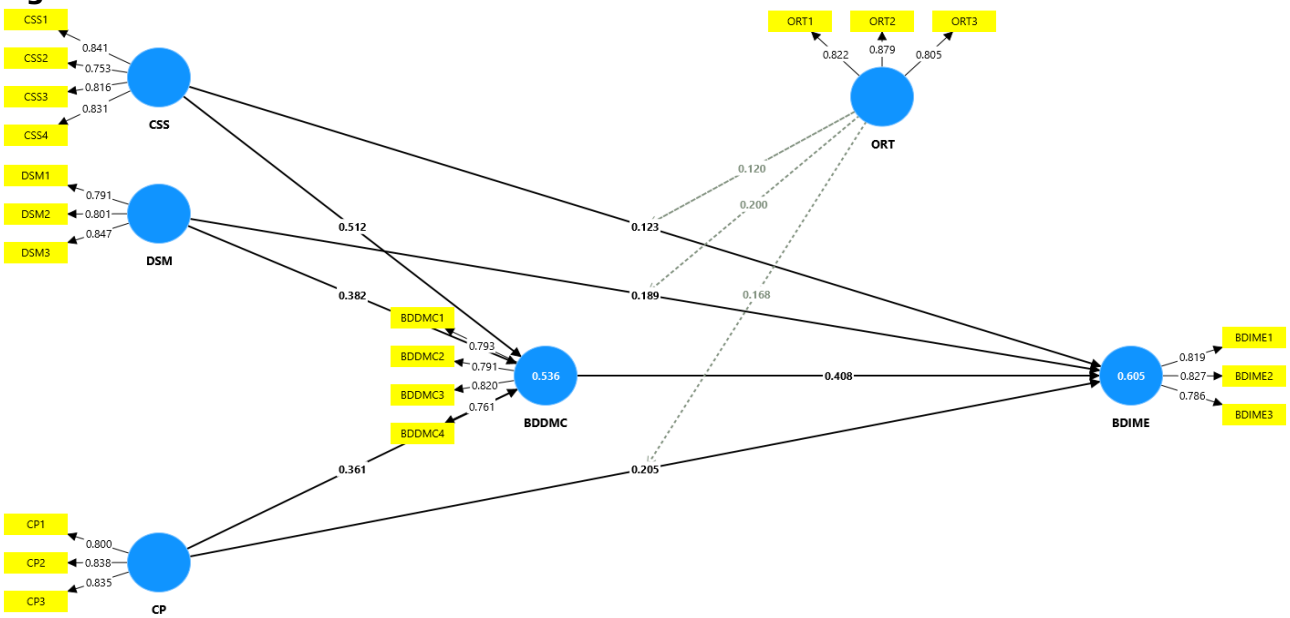
	BDDMC	BDIME	CP	CSS	DSM	ORT
BDDMC1	0.793	0.531	0.27	0.446	0.293	-0.003
BDDMC2	0.791	0.505	0.38	0.328	0.289	-0.02
BDDMC3	0.82	0.456	0.3	0.389	0.302	-0.011
BDDMC4	0.761	0.477	0.335	0.421	0.219	-0.012
BDIME1	0.547	0.819	0.389	0.215	0.254	0.224
BDIME2	0.518	0.827	0.304	0.294	0.31	0.206
BDIME3	0.445	0.786	0.261	0.241	0.173	0.311
CP1	0.315	0.25	0.8	0.04	0.065	-0.079
CP2	0.324	0.346	0.838	0.015	0.095	0.023
CP3	0.359	0.367	0.835	0.096	-0.068	0.073
CSS1	0.441	0.273	0.089	0.841	-0.091	0.001
CSS2	0.36	0.176	0.027	0.753	-0.028	0.04
CSS3	0.395	0.276	0.009	0.816	-0.076	0.048
CSS4	0.424	0.261	0.073	0.831	-0.079	-0.037
DSM1	0.255	0.229	0.074	-0.122	0.791	-0.077
DSM2	0.269	0.228	0.016	-0.065	0.801	-0.04
DSM3	0.321	0.283	-0.005	-0.035	0.847	-0.059
ORT1	-0.028	0.229	0.013	0.015	-0.094	0.822
ORT2	0.061	0.306	0.06	0.042	-0.034	0.879
ORT3	-0.103	0.203	-0.061	-0.038	-0.062	0.805

4.1. Measurement Model

The measurement model for a study that investigates cloud security and compliance as well as decision-making capabilities and organizational readiness is shown in the diagram (Figure 2). Cloud security solutions consists of four indicators (CSS1 to CSS4) which produce loadings between 0.753 and 0.841. The high value of the loadings demonstrates strong reliability and effective measure representation of cloud security solutions through each indicator. Three indicators (DSM1 to DSM3) sufficiently measure data security measures construct because they demonstrate loadings between 0.791 to 0.847. Experimental data shows that the compliance practices construct has excellent representation via three indicators (CP1 to CP3) with loadings that reach between 0.800 to 0.838. The big data decision-making capability consists of four indicators which demonstrate loadings ranging from 0.761 to 0.820 (BDDMC1 to BDDMC4). This shows that these items adequately capture the essence of decision-making capability in the context of big data. The construct *organizational readiness for technology* is assessed through three indicators (ORT1 to ORT3) with loadings from 0.822 to 0.879, demonstrating a high level of consistency in measuring organizational readiness for technology adoption.

The construct *big data information management effectiveness* is represented by three indicators (BDIME1 to BDIME3), with a composite reliability of 0.605, which is just above the threshold of 0.6 often considered acceptable in exploratory research. Item loadings are from 0.786 to 0.827, illustrating that these indicators effectively measure the construct. The diagram also includes path coefficients, which are depicted as lines connecting different constructs. These coefficients indicate the strength and direction of the relationships between constructs. For example, the paths from BDDMC to BDIME show significant influences with coefficients like 0.408, suggesting a strong impact of decision-making capability on information management effectiveness. The dotted lines in the diagram potentially represent moderating effects, indicating that the relationship between two constructs might be influenced by a third variable (e.g., the influence of BDDMC on BDIME could be moderated by ORT).

Figure 2: Measurement Model



4.2. Path Analysis

The summary table 7 provides results from path analytic research that investigates relationships between BDDMC, BDIME, CP, CSS, DSM and ORT constructs. This analysis includes evaluations of ORT relationships with DSM and CSS and CP as well as their respective effects on BDIME. The following analysis disturbs the functional and meaningful aspects of each model parameter through the research data:

The path coefficient and T-value analysis demonstrates an extremely important positive connection between BDDMC and BDIME. The p-value of 0.000 indicates statistical significance which demonstrates that better organizational decision capabilities highly boost the effectiveness of information management.

The implementation of compliance practices creates substantial positive effects on decision-making capability. Strong evidence confirms this relationship because of both high T-values and the minimal p-value. Better compliance practices demonstrate an important positive link to information management effectiveness since effective compliance leads to superior management results.

An exceptionally vigorous and statistically meaningful direct link between cloud security solutions highlights their essential role in developing superior big data decision-making operations. The relationship between cloud security and big data management effectiveness is positive but moderate while decision-making capability receives stronger benefits from this association. Robust security measures that protect data have an important positive effect on decision-making capability because they create stronger capabilities for big data decisions. Security measures connected to data encryption establish similar positive effects on information management effectiveness as cloud security through sustained big data management importance. The outcomes of big data information management demonstrate better performance among organizations that demonstrate preparedness and readiness toward technological changes. Data security measures possess greater influence on information management effectiveness when organizations demonstrate higher levels of readiness according to the significant interaction term. The results demonstrate that both cloud security solutions and compliance practices increase big data information management effectiveness when organizations show readiness to implement these solutions properly.

The examined relationships in this table demonstrate considerable positive connections which demonstrate the fundamental importance of compliance and security measures and organizational readiness for advancing both decision-making abilities and big data management effectiveness. Organizational readiness emerges as the critical component which enhances the effects of other variables on big data information management effectiveness. The research results

validate the theoretical part of this study and confirm the established relationships among variables in the cloud computing and big data phenomenon within organizational frameworks.

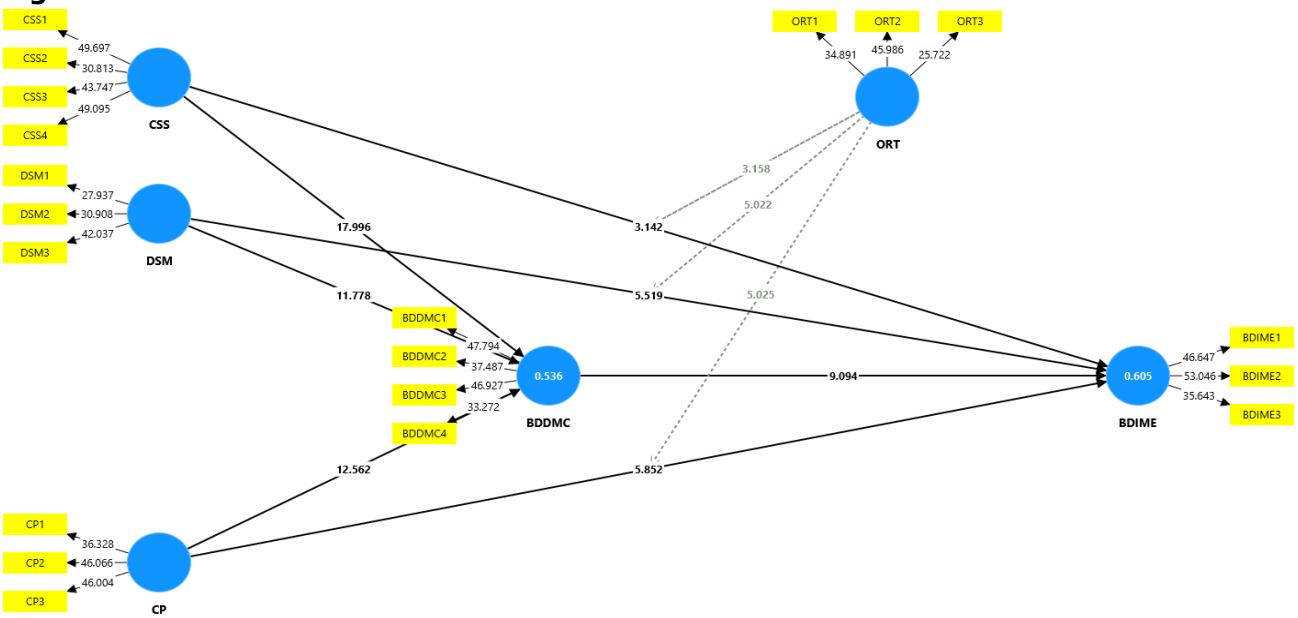
Table 7: Path Analysis

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
BDDMC -> BDIME	0.408	0.407	0.045	9.094	0.000
CP -> BDDMC	0.361	0.361	0.029	12.562	0.000
CP -> BDIME	0.205	0.203	0.035	5.852	0.000
CSS -> BDDMC	0.512	0.511	0.028	17.996	0.000
CSS -> BDIME	0.123	0.123	0.039	3.142	0.002
DSM -> BDDMC	0.382	0.383	0.032	11.778	0.000
DSM -> BDIME	0.189	0.189	0.034	5.519	0.000
ORT -> BDIME	0.318	0.318	0.037	8.521	0.000
ORT x DSM -> BDIME	0.200	0.196	0.040	5.022	0.000
ORT x CSS -> BDIME	0.120	0.118	0.038	3.158	0.002
ORT x CP -> BDIME	0.168	0.165	0.033	5.025	0.000

4.3. Structural Model

Figure 3 depicts the results derived from Structural Equation Modeling (SEM) for evaluating relational patterns between Cloud Security Solutions (CSS), Data Security Measures (DSM), Compliance Practices (CP), Big Data Decision-Making Capability (BDDMC), Organizational Readiness for Technology (ORT), and Big Data Information Management Effectiveness (BDIME). The structural model validates the robust interconnections of security and compliance practices that affect decision-making capability which leads to improved information management effectiveness. The readiness of technology within an organization has a crucial influence on information management performance along with influencing the effects of other constructs upon BDIME since it demonstrates the significant role of organizational elements to maximize technological benefits. All indirect effects in the model show enhancement patterns that verify theoretical frameworks because superior security practices and compliance standards and organization readiness levels improve decision-making capabilities as well as information management outcomes. The diagram shows how different elements involving cloud security and data management work together with organizational readiness to improve information management effectiveness in organizations.

Figure 3: Structural Model



5. Discussion

Research results from this study demonstrate the sophisticated connection among cloud security solutions, compliance practices, data security measures, organizational readiness for technology, big data decision-making ability and big data information management effectiveness.

The research findings affirm academic studies of big data management together with cloud computing by demonstrating complex linkages among these entities in Chinese business settings. Research results support the vital function of CSS and DSM when they are used to enhance both BDDMC and BDIME. A meaningful path exists between CSS and DSM toward BDDMC and BDIME which supports findings from Kaufman (2009) as well as D. Chen and Zhao (2012) who illustrate how strong security measures protect data integrity while enabling dependable cloud decisions. The research by Sehgal, Bhatt, and Acken (2020) demonstrates that secure cloud computing frameworks improve management capabilities while recognizing that observational results in our model validate this connection.

External research studies validate the effect of CP on both BDDMC and BDIME. Kim and Kim (2017) together with Root (2019) establish that compliance measures both legal norms and ethical standards through a formal approach to security management and data administration which ultimately drives better decision outcomes. According to Langevoort (2017) data management practices require compliance because the relationship between these managerial practices demonstrates this requirement through the identified path coefficients. The relationship between these practices and BDIME receives a vital boost through ORT implementation because this demonstrates an organization's capability to enact new technologies successfully. Organizational readiness serves as a critical factor for technology utilization according to A. Sharma and Venkatraman (2023) and Lokuge et al. (2019). This research assesses the effect that ORT has on security and compliance practices to enhance information management effectiveness. Research conducted by Awan et al. (2021) and Nisar et al. (2021) proves the essential relationship between BDDMC and BDIME which contributes to big data utilization for both performance improvement and sustainability goals. The robust correlation in this research demonstrates a direct relationship where firms enhance their decision frameworks which results in improved big data utilization and management effectiveness according to Shamim et al. (2019).

6. Conclusion

A thorough research analyzed the complex connections which exist between Cloud Security Solutions (CSS), Compliance Practices (CP), Data Security Measures (DSM), Organizational Readiness for Technology (ORT), Big Data Decision-Making Capability (BDDMC), and Big Data Information Management Effectiveness (BDIME for Chinese enterprises employing cloud computing technology. Statistical evidence generated by structural model analysis shows the constructs interact to determine the effectiveness of big data management since this aspect advances strategic business success in contemporary organizations. The results from the path analysis reveal several critical insights. The analysis confirms that CSS along with DSM enhance BDDMC through their vital contributions to effective decision-making processes which depend on complete security measures. The findings demonstrate that strict adherence to CP standards enhances both BDDMC and BDIME thus showing that data integrity safeguards create better information management practices. The study results that explained the moderating effect of ORT proved to be most important. ORT directly influenced BDIME and significantly increased the effectiveness of CSS and DSM and CP on BDIME because sound organizational infrastructure and readiness enable optimal data management through technology usage. BDDMC and BDIME maintain a strong association since reliable decision-making technologies incorporating effective data analytics and security solutions provide direct benefits to big data management practices.

6.1. Theoretical and Practical Implications

Through theory this research introduces new detailed knowledge about how security measures together with compliance standards and organization readiness affect data management effectiveness in cloud computing systems. Practically, it offers actionable insights for business leaders and IT managers on prioritizing investments in security, compliance, and training programs to boost their firm's data management effectiveness.

6.2. Future Research Directions

Future studies could explore the causal relationships between these constructs across different industries and cultural contexts to generalize the findings. Additionally, examining the impact of emerging technologies such as artificial intelligence and machine learning within the security and decision-making frameworks could provide deeper insights into future challenges and opportunities in big data management.

Appendix

Construct	Survey Statement	Likert Scale
Cloud Scalability Solutions	1. Our cloud infrastructure dynamically scales resources based on data demands.	1-5
	2. Our resource allocation algorithms efficiently manage cloud resources.	1-5
	3. Our system can manage sudden spikes in data load without disruption.	1-5
	4. Our cloud infrastructure integrates elastic computing resources to optimize performance.	1-5
Data Security Measures	1. We implement advanced encryption techniques to protect data at rest and in transit.	1-5
	2. We use robust access control mechanisms to prevent unauthorized data access.	1-5
	3. We conduct regular security audits to identify and mitigate vulnerabilities.	1-5
Compliance Practices	1. We comply with international data protection regulations like GDPR.	1-5
	2. We have implemented compliance training programs for our employees.	1-5
	3. We regularly update our compliance policies to reflect new regulations.	1-5
Big Data Decision-Making Capabilities	1. We integrate various data sources to improve decision-making accuracy.	1-5
	2. We utilize predictive analytics to inform strategic decisions.	1-5
	3. We adopt decision support systems that leverage real-time data.	1-5
	4. We are capable of transforming big data insights into actionable strategies.	1-5
Big Data Information Management Effectiveness	1. The information generated from our big data analyses is accurate.	1-5
	2. Our data retrieval and processing for operational use are timely.	1-5
	3. Users are satisfied with our information management system.	1-5
Organizational Readiness for Technology	1. Our technological infrastructure is prepared to support new systems.	1-5
	2. Our employees are ready and willing to adopt new technological solutions.	1-5
	3. Our organizational culture supports continuous technological learning and adaptation.	1-5

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