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Cloud-Based Big Data Governance and Decision-Making Capabilities in South Africa: The Roles of Organizational Readiness, Data Security, Compliance, and Scalability

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ABSTRACT

Cloud-based big data governance is now a key management issue among organizations in South Africa that aim to enhance the security of their data, regulatory compliance, the effectiveness of their information management, and evidence-based decision-making. This paper examines the impact of organizational readiness for technology, data protection, and compliance practices on the big data decision-making abilities of South African companies, where the effectiveness of big data information management and cloud scalability solutions serve as mediation and moderation variables, respectively. A quantitative cross-sectional research design was used, and 500 professionals in the field of cloud-related work were used as the primary data. Partial Least Squares Structural Equation Modeling was used to analyze the proposed model with the help of Smart-PLS. The results indicate that organizational readiness for technology, data security, compliance practices, and cloud scalability solutions have positive effects on big data decision-making capabilities in the cloud-based organizational setting in South Africa. The effectiveness of big data information management is also a notable mediating variable, as it elaborates how organizational and technological variables are transformed into better decision-making ability. In addition, cloud scalability solutions enhance the influence of organizational preparedness, data protection, and compliance procedures on big data decision-making abilities. The study adds to the body of management and digital governance by introducing an integrated model. In practice, the results offer practical advice to managers, IT leaders, compliance officers, and cloud service professionals in South Africa to design secure, scalable, and governance-oriented cloud data management systems that facilitate strategic decision-making.

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1. Introduction

Cloud computing functions as a fundamental technology within the modern digital transformation where it transforms organizational approaches to data handling and strategic determination. Multiple operational and strategic planning barriers confront businesses of all sectors that implement cloud-based solutions. Cloud infrastructure

architecture alongside management faces four vital challenges which involve data security together with regulatory compliance and scalability with organizational readiness.

Data security remains the top priority in cloud operations since vulnerabilities allow sensitive information to face major security threats. Having an open distributed nature makes cloud environments vulnerable to multiple security threats which attack data security as well as compromise confidentiality. The defense of data tasks upon assessment remains vital because proper security standards represent necessary solutions to defeat unlawful system intrusions and cyber security challenges. Al-Ali et al. (2024) explain that implementing IoT technologies into big data management systems brings solution-demanding security challenges that need modern protection techniques for data security. Security solutions need customizable features which match both the increasing magnitude and advanced nature of cloud services according to the research of Al-Said Ahmad and Andras (2019).

Data security compliance with international protection regulations presents a major challenge to organizations which choose cloud services. Multinational organizations struggle with numerous legal requirements because these rules tend to be complex and highly dissimilar across different jurisdictions. The authors Alrawhani et al. (2025) demonstrate that implementing protection motivation theory as a framework for information security policy compliance brings better data governance to cloud-based environments. Flawless information protects legal stability together with customer trust most significantly in fields that need strong data privacy measures. A company's ability to accept cloud technology serves as the main factor for leveraging cloud computation to optimize operational workflows and enhance strategic planning. The organizations which possess strong capabilities to implement new technologies gain more advantages from cloud computing implementations. Nisar et al. (2020) establish through their study that organizations achieve better environmental outcomes when they have strong capabilities to manage big data because readiness to adopt data analytics leads to improved efficiency and strategic decision-making. In his study Mitchell and Meggison (2014) demonstrates why organizations need compliance theory to improve their readiness for regulatory requirements when implementing advanced cloud solutions.

Cloud computing enables organizations to handle their resources based on their requirements through the significant feature of scalability. Efficient workload management requires the ability to scale IT resources when needed because data-intensive operations demand this capability. Business model scalability in the cloud receives analysis from Juntunen et al. (2018) who acknowledge efficient operation scaling serves as a strategic advantage for survival in quickly evolving markets. Fadnavis et al. (2021) present guidelines about how to optimize cloud service scalability alongside performance outcomes through technical implementation and management methods which improve cloud infrastructure effectiveness. The practice of efficient big data management inside cloud environments leads to better decision-making abilities. Organizations understand critical aspects of strategic planning as well as operational decision-making through their ability to quickly process big data volumes. The paper by Hossain et al. (2024) demonstrates that big data analytics when integrated into management information systems creates business intelligence which supports better decision processes. The authors (Tabesh et al., 2019) confirmed in their study how organizations require superior data management capabilities for executing big data strategies effectively therefore maximizing their organizational achievements.

The foundation for understanding the effects of these elements on organizational strategic decision processes goes first through a discussion about data security aspects and system scalability requirements plus big data management details and organizational readiness requirements and data compliance needs. The investigation seeks to discover important data for enhancing cloud computing infrastructure performance while enhancing business effectiveness throughout the digital transformation period. These outlined objectives seek to link academic theories with practical solutions which will support organizations to better manage their cloud data systems. The goals serve as foundations for all subsequent sections within this work. In addition, the study considers how these relationships may inform cloud-based data governance and decision-making in South Africa.

1.1. Objectives of the Study

1. Analyzing the consequences which data security measures have on decision-making capabilities of big data applications inside cloud computing frameworks.
2. The study explores how compliance practices affect the abilities of organizations to utilize big data information for decisions.
3. The study assesses how technology preparedness at organizational levels affects the improvement of big data decision-making capabilities.
4. The assessment of cloud scalability solutions for their influence on big data decision-making effectiveness.
5. Big data information management effectiveness serves as an intermediary link between the influence of data security measures on big data decision-making capabilities.
6. Big data information management effectiveness serves as the mediator to understand the influence between compliance practices and big data decision-making capabilities.
7. The present research determines how information management effectiveness from big data acts as a mediator when linking organizational technology readiness to big data decision-making abilities.
8. The study investigates how effective big data information management functions as a connection between cloud scalability solutions and big data decision-making processes.

2. Literature Review

Cloud-based data management controls the entire information management sector through its limitless scalability and adaptable features and performance standards. The benefits of cloud technology entail difficulties which organizations need to handle to exploit its capabilities. The literature evaluation analyzes how data protection measures together with compliance methods and organizational preparedness and cloud infrastructure scalability affect decision-making operations in cloud computing platforms.

2.1. Data Security Measures

Protection of data represents the most important issue within the cloud computing domain. Strong security measures need to be implemented to handle vulnerabilities that stem from cloud services' open distribution because these weaknesses threaten both data integrity and confidentiality (Chen & Zhao, 2012; Kaufman, 2009). Approved security standards yield better strategic decision capabilities through their capability to deliver safe and dependable data accessibility. Operational continuity and customer trust preservation and regulatory compliance become essential because of this condition. Root (2019) confirms the finding from Sehgal et al. (2020) about the complex nature of implementing flexible security solutions which need to adapt to technological developments. Data security measures demonstrating strong effectiveness lead to better big data decision capabilities according to Hypothesis 1 (H1). These findings are supported by the necessity of secure data protection systems.

2.2. Compliance Practices

Cloud computing faces important compliance issues because its worldwide operations overlap with the many regulations that control data privacy and security conditions within different national boundaries. The implementation of compliance practices aims to create both regulatory compliance adherence systems and secure data governance platforms which improve information management quality (Kim & Kim, 2017; Sharma & Venkatraman). The proper management of data through legal-compliant methods allows organizations to support systematic decision systems. The management of compliance remains a challenge within cloud environments that serve multiple entities because data from various sources persists in the system according to Langevoort (2017) and Mitchell and Meggison (2014). The establishment of strong compliance practices serves to enhance decision capabilities through their creation of structured secure data management systems (H2).

2.3. Organizational Readiness for Technology

Organizations must assess their readiness levels to successfully implement cloud technologies because readiness includes cultural characteristics along with IT infrastructure and staff expertise and their primary approach to technological adoption (Naghib et al., 2022). The ability of a company to utilize cloud solutions that support data management together with decision-making processes gets defined by its organizational readiness level. According to Lokuge et al. (2019) and Snyder-Halpern (2001) research demonstrates that organizations achieving greater readiness through preparedness bring better outcomes in cloud technology implementations. The third hypothesis (H3) demonstrates that enhanced technology readiness within organizations creates constructive effects on their big data decision systems.

2.4. Cloud Scalability Solutions

Cloud computing delivers its most critical benefit through its feature which allows users to adjust system resources based on changing needs. Business success demands effective scalability solutions because these enable proper handling of vast data volumes while accommodating organizational requirements that change frequently. The capability enables efficient data management system resource adjustment which supports better decisions through optimized performance and preserved data integrity (Brataas et al., 2017; Fadnavis et al., 2021). Decision-making performance benefits from robust cloud scalability solutions because these solutions guarantee essential responsiveness and adaptability in data management operations (H4).

Table 1
Summary of Literature Review

Author(s) & Year	Key Findings	Relevance to Hypotheses
(Naghib et al., 2022)	Reviews big data management techniques in IoT	Discusses readiness in technology integration. (Supports H3)
(Fadnavis et al., 2021)	Focuses on optimizing scalability and performance in cloud services	Emphasizes scalability's role in data management. (Supports H4)
(Awan et al., 2021)	Examines big data analytics and decision-making capabilities	Mediating role of information management. (Supports H5-H8)
(Duong & Ke-Duc Le, 2021)	Measures impact of security factors on e-payment trust	Security measures' impact on decision-making. (Supports H1)
(Sehgal et al., 2020)	Explores cloud computing with a focus on security and scalability	Links security and scalability to effective management. (Supports H1 and H4)
(Lokuge et al., 2019)	Explores organizational readiness for digital innovation	Organizational Readiness impacts decision-making. (Supports H3)
(Shamim et al., 2019)	Highlights the role of big data management in decision-making	Mediating role of information management. (Supports H5-H8)
(Root, 2019)	Discusses the process of compliance in organizations	Compliance's role in structured management. (Supports H2)
(Kim & Kim, 2017)	Analyzes compliance support systems in improving security behaviors	Compliance Practices influence decision-making. (Supports H2)
(Langevoort, 2017)	Reviews compliance cultures in corporations	Links compliance to structured data management. (Supports H2)
(Brataas et al., 2017)	Studies scalability analysis of cloud services	Cloud Scalability influences decision-making. (Supports H4)
(Subramaniama et al., 2017)	Investigates employee perceptions of workplace safety and compliance	Links compliance to organizational practices. (Supports H2)
(Chen & Zhao, 2012)	Discusses the critical security measures in cloud environments	Data Security Measures influence decision-making. (Supports H1)
(Kaufman, 2009)	Examines data security in cloud computing	Highlights the importance of robust security measures. (Supports H1)
(Snyder-Halpern, 2001)	Studies organizational readiness for IT systems innovation	Organizational readiness influences technology adoption. (Supports H3)

2.5. Mediating Role of Information Management Effectiveness

The quality of information management depends on how readily accessible data is combined with its accuracy and its ability to maintain time sensitivity since these parameters enable sound decision making. The strategic decisions of organizations improve

through data management since this lets them properly utilize their data resources (Awan et al., 2021; Shamim et al., 2019). This review posits that the quality of information management mediates the impact of security, compliance, readiness, and scalability on decision-making capabilities. This research establishes H5 through H8 because effective information management acts as the essential intermediate to deliver better decision-making outcomes from IT capabilities.

The evaluation presents a full understanding about how security, compliance, scalability, organizational readiness and their cumulative effects on decision outcomes are enabled by effective information management in cloud environments. The study investigates these relationships to advance comprehension of cloud data management strategic issues and prospects.

3. Data And Methodology

The conducted study utilized this segment to describe its research design parameters and sampling method together with data collection methods and variable measurement techniques and data analysis procedures and ethical protocols. The primary objective established to analyze data management issues in South African cloud infrastructure through a quantitative assessment of primary information sources.

3.1. Research Design

The study used a quantitative cross-sectional research format because it works well for studying multiple construct relationships at one point in time. This study employed SEM to analyze conceptual design through a theory-based approach which understands BDDMC as the product of both organizational and technological elements through BDIME as a mediating force. The structural design of the study is given in figure 1 below:

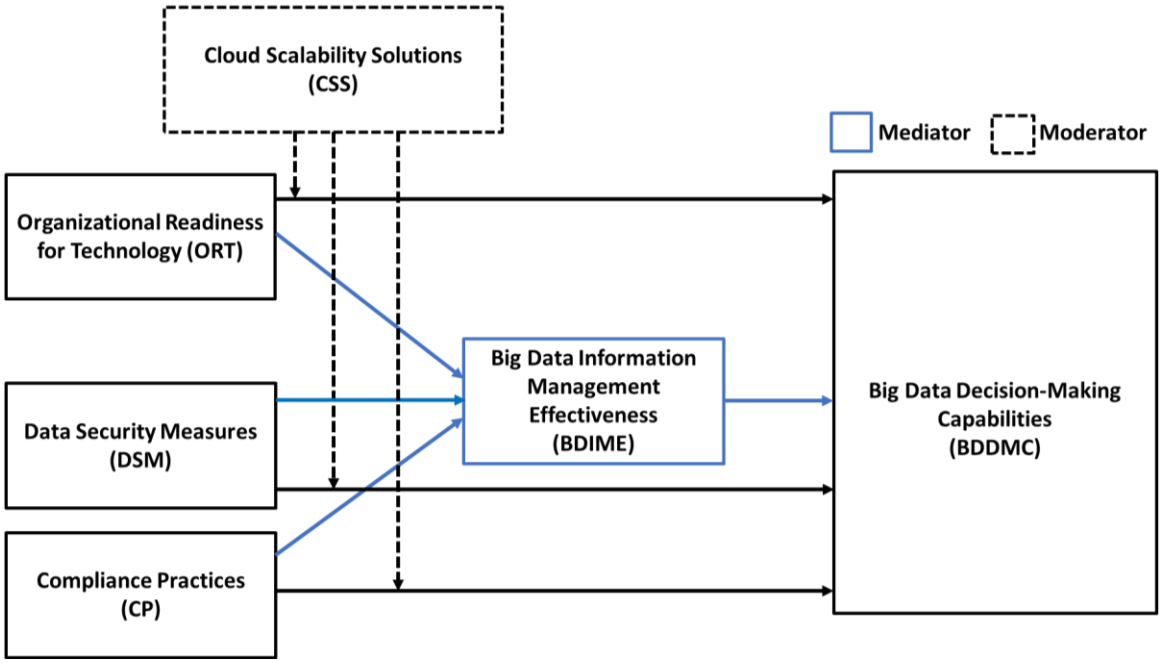


Figure 1: Structural Design of the Study

Empirical data acquisition from key informants working in organizations where cloud-based data management takes place was performed to validate theoretical relationships.

3.2. Population and Sampling

The research focused on IT specialists and data professionals who worked in cybersecurity, compliance and cloud infrastructure and data management fields at companies adopting cloud-based data systems or in the implementation phase. Among the participants who completed this research were professionals from technology, finance, e-

commerce, healthcare and manufacturing industries which use cloud-based systems to handle big data. A purposive sampling technique was employed to ensure the inclusion of respondents with relevant knowledge and decision-making authority regarding data management practices. In total, data were collected from 500 potential respondents, including IT managers, systems analysts, compliance officers, cloud architects, and data engineers. The sample size meets the requirements for PLS-SEM analysis and enhances the robustness and generalizability of the results.

Table 2
Constructs and Items

Construct	Item Description	Citation
Organizational Readiness for Technology (IV)	1. Technical readiness of infrastructure to operate new 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)
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.	(Alrawhani et al., 2025; Chen et al., 2021; Sulistio, 2023)
Compliance Practices (IV)	1. Compliance with applicable data protection regulations such as POPIA. 2. The organization should introduce employee compliance training programs. 3. The organization needs to update compliance policies through regular maintenance which reflects new regulations.	(Alrawhani et al., 2025; Kim & Kim, 2017)
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.	(Bai et al., 2021; Shamim et al., 2019)
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., 2017; Shamim et al., 2019)
Cloud Scalability Solutions (Moderator)	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; Karras et al., 2024; Sharma & Chaturvedi, 2021)

3.3. Data Collection Method

Primary data was collected using a structured questionnaire, which was administered both online and in paper-based formats to accommodate the preferences of the target respondents. The questionnaire was initially prepared in English to improve comprehension and accuracy. Respondents were informed about the purpose of the study and were asked to rate their responses on a seven-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree). The questionnaire comprised items measuring the constructs in the research model, including independent variables, the mediator, and the dependent variable. To ensure content validity, the questionnaire was pre-tested with a small group of experts in the fields of information systems and cloud computing. Their feedback led to minor refinements in wording and clarity before full-scale distribution.

3.4. Measurement of Variables

All constructs in the structural model were measured using validated multi-item scales derived from prior literature and adapted for the cloud computing context. Each construct had at least three items to ensure internal consistency and construct validity.

Organizational Readiness for Technology (ORT) was focusing on the organization's preparedness for cloud and big data adoption. Decision Support Management (DSM) items reflected the organization's infrastructure and tools for supporting high-quality decision-making. Compliance Practices (CP) were measured using indicators of adherence to data privacy, security, and regulatory frameworks. Cloud Scalability Solutions (CSS) were measured based on respondents' perceptions of their cloud infrastructure's ability to expand and adapt efficiently. Big Data Information Management Effectiveness (BDIME) was captured by items indicating how well the organization integrates, secures, and utilizes its big data resources. Big Data Decision-Making Capabilities (BDDMC), the dependent variable, reflected the organization's ability to use big data insights for strategic decision-making. The constructs and their items used are given in the table 2 below.

3.5. Data Analysis Technique

The collected data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) via SmartPLS 4 software. This technique was appropriate due to its ability to handle complex models with multiple constructs, indicators, and mediation/moderation effects while remaining robust against non-normal data distributions. The analysis process involved the following steps (figure 2):

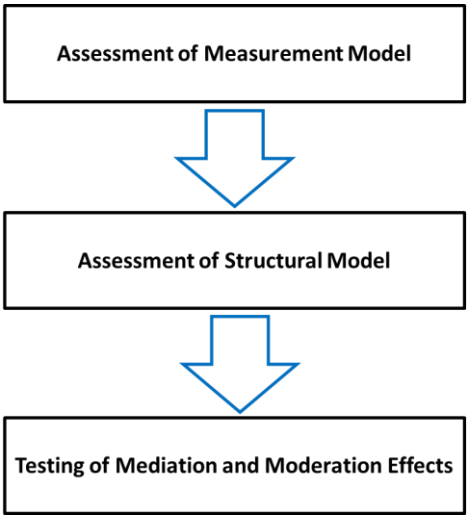


Figure 2: Steps involved in the Analysis

Assessment of measurement model includes the evaluation of indicator reliability, internal consistency, convergent validity, and discriminant validity. Assessment of structural model consists of the analysis of path coefficients, significance values, R^2 values, and f^2 effect sizes to determine the strength of relationships. Testing of mediation and moderation

effects involves bootstrapping procedures (5000 resamples) were applied to test the significance of indirect effects (mediation) and interaction terms (moderation). The model's predictive relevance (Q^2) and goodness of fit were also examined to ensure the reliability and validity of the results. Construct reliability was assessed through Cronbach's alpha, Composite Reliability (CR), and Average Variance Extracted (AVE), while validity was verified using convergent and discriminant validity tests including Fornell-Larcker and HTMT criteria.

3.6. Ethical Considerations

This research adhered to the ethical standards for conducting human-subject research. Participants were informed about the study's objectives, and informed consent was obtained before administering the questionnaire. The data collected were treated with strict confidentiality and used solely for academic purposes. Participation was entirely voluntary, and respondents were assured that they could withdraw at any time without any consequences. No personal identifiers were collected to maintain anonymity, and data storage complied with institutional guidelines and South African data protection regulations. The researcher received Institutional Review Board (IRB) approval from their affiliated institution for the study to maintain ethical principles and data protection specifications.

4. Results

The convergent validity tests (table 3) demonstrate an effective measurement model since they confirm the reliable and valid measurement of each construct in the research. Each measurement factor in Big Data Decision-Making Capability, Big Data Information Management Effectiveness, Compliance Practices, Cloud Scalability Solutions, Decision Support Management, and Organizational Readiness for Technology exceeds the necessary item loading threshold of 0.7. Every survey item plays a properly important role in measuring its individual construct.

The constructs exhibit internal reliability levels ranging from good to excellent based on a Cronbach's Alpha scale between 0.732 to 0.873. The values show strong correlation between the measuring variables which align with their conceptual components. All measured constructs possess consistent measurement with high accuracy because their Composite Reliability scores range from 0.7 to above 0.8.

Table 3
Convergent Validity Test

Constructs	items	Loading	Alpha	CR	AVE
BDDMC	BDDMC1	0.838	0.84	0.893	0.677
	BDDMC2	0.868			
	BDDMC3	0.825			
	BDDMC4	0.756			
BDIME	BDIME1	0.811	0.732	0.848	0.651
	BDIME2	0.836			
	BDIME3	0.771			
CP	CP1	0.887	0.82	0.887	0.725
	CP2	0.774			
	CP3	0.887			
CSS	CSS1	0.881	0.856	0.902	0.698
	CSS2	0.836			
	CSS3	0.823			
	CSS4	0.801			
DSM	DSM1	0.903	0.873	0.921	0.796
	DSM2	0.874			
	DSM3	0.899			
ORT	ORT1	0.883	0.855	0.912	0.775
	ORT2	0.863			
	ORT3	0.894			

The Average Variance Extracted (AVE) values for constructs surpass the essential benchmark of 0.5 while reaching between 0.651 to 0.796. The constructs demonstrate strong convergent validity because they explain most of the observed variable variance. Construct validity is established through high AVE values since indicators associated with a

construct explain more variability than measurement errors. These high levels of reliability and validity within the measurement model create an effective basis for continuing analysis. The model demonstrates effective measuring capabilities which support the integrity and credibility of future analyses through its consistent measure of cloud computing data management constructs.

HTMT ratio results (table 4) serve as an effective approach to assess the discriminant validity between involved constructs. Statistical distinctness of different constructs within the model serves to prove that each construct represents distinct phenomenon aspects. The ratio of 0.714 between Big Data Decision-Making Capability (BDDMC) and Big Data Information Management Effectiveness (BDIME) demonstrates a distinct link in addition to moderate construct similarity showing data management capability measurement divergence.

The HTMT values measuring the relationships between Compliance Practices (CP) and BDDMC, BDIME, CSS, DSM, ORT present very low scores which range from 0.088 to 0.292. These significantly low values indicate a strong discriminant validity, affirming that CP is distinctly different from these constructs, capturing unique aspects without substantial overlap. Similarly, CSS demonstrates robust discriminant validity when compared with other constructs. The values against BDDMC, BDIME, DSM, and ORT range from 0.036 to 0.238, reinforcing that CSS uniquely captures the scalability aspect of cloud infrastructures, distinct from decision-making capabilities, information management effectiveness, support management, and organizational readiness.

The discriminant validity between DSM and other constructs also supports distinct statistical separations, especially notable with CP, CSS, and ORT, where HTMT values are particularly low (from 0.048 to 0.11). These results confirm that DSM uniquely measures aspects of decision support management without significant overlap with the scalability, compliance practices, or organizational readiness. Lastly, the HTMT ratios involving ORT show that while it shares a moderate relationship with BDDMC and BDIME (with values of 0.607 and 0.574, respectively), it remains statistically distinct enough to justify separate constructs. The lower HTMT values with CP, CSS, and DSM reinforce ORT's unique position in measuring the readiness of an organization to adopt and integrate cloud technologies effectively.

Overall, these HTMT ratio results substantiate the discriminant validity across all constructs within the model, confirming that each construct measures different aspects of the overarching theme of data management challenges in cloud computing infrastructures. A clear statistical distinction is critical to ensure model reliability because it lets researchers make specific conclusions regarding how factors affect data management and decision-making within cloud systems.

Table 4
HTMT Ratio

	BDDMC	BDIME	CP	CSS	DSM	ORT
BDDMC						
BDIME	0.714					
CP	0.292	0.088				
CSS	0.238	0.187	0.036			
DSM	0.448	0.478	0.048	0.11		
ORT	0.607	0.574	0.134	0.053	0.047	

The results from Fornell-Larcker analysis (table 5) confirm the distinct validity of research constructs in this study. BDDMC achieves an AVE square root measurement of 0.823 that surpasses any of its connections with the other constructs. The highest correlation of BDDMC exists with Organizational Readiness for Technology (ORT) at 0.515 but this figure stands significantly lower than the AVE square root indicating satisfactory discriminant validity. The AVE square root value of 0.807 for Big Data Information Management Effectiveness (BDIME) surpasses all its correlations with other constructs. BDIME and BDDMC demonstrate the highest relationship based on 0.566 but still fall short of the AVE square root leading to good discriminant validity.

The AVE square root of 0.851 from Compliance Practices (CP) establishes a significant gap above all other construct correlations with BDDMC exhibiting its only 0.263 value. The substantial divergence in evaluation results establishes a new criterion between CP and all other constructs regarding their measurement objectives. The square root of the Average Variance Extraction for Cloud Scalability Solutions reaches 0.836 while demonstrating maximum correlation of 0.202 with BDDMC. These results indicate strong discriminant validity, suggesting CSS uniquely captures aspects not covered by the other constructs.

Decision Support Management (DSM) has an AVE square root of 0.892, which is considerably higher than any of its correlations with other constructs, with the highest being 0.388 with BDDMC. This emphasizes the distinctiveness of DSM from other constructs in the model. Organizational Readiness for Technology (ORT) with an AVE square root of 0.88 shows strong discriminant validity as well. The correlations of ORT with other constructs are considerably lower, with the highest correlation being 0.515 with BDDMC.

The Fornell-Larcker criterion results clearly show that all constructs in the model are well-differentiated from each other. Each construct shares more variance with its indicators than with other constructs, which is crucial for the validity of construct measurement in this research. This confirms the constructs are distinct and measure different dimensions of data management challenges in cloud computing, providing a solid foundation for reliable and valid conclusions from this study.

Table 5
Fornell-Larcker

	BDDMC	**BDIME**	**CP**	**CSS**	**DSM**	**ORT**
BDDMC	0.823					
BDIME	0.566	0.807				
CP	0.263	0.066	0.851			
CSS	0.202	0.151	0.011	0.836		
DSM	0.388	0.387	0.038	0.097	0.892	
ORT	0.515	0.454	-0.101	-0.03	0.035	0.88

The table of cross-loadings (table 6) helps assess the discriminant validity by comparing the loadings of indicators on their own constructs against their loadings on other constructs. This comparison is crucial to ensure that each indicator more strongly measures its intended construct than any other, reinforcing the distinctiveness of each construct within the model. For Big Data Decision-Making Capability (BDDMC), the indicators (BDDMC1, BDDMC2, BDDMC3, BDDMC4) have the highest loadings on their own construct, ranging from 0.756 to 0.868, compared to their loadings on other constructs such as Big Data Information Management Effectiveness (BDIME), Compliance Practices (CP), Cloud Scalability Solutions (CSS), Decision Support Management (DSM), and Organizational Readiness for Technology (ORT). This pattern confirms strong discriminant validity as each indicator primarily reflects its respective construct, with the highest secondary loadings being substantially lower, for instance, 0.513 on BDIME for BDDMC2.

For Big Data Information Management Effectiveness (BDIME), indicators like BDIME1, BDIME2, and BDIME3 also demonstrate higher loadings on BDIME (ranging from 0.771 to 0.836) compared to their loadings on other constructs. This pattern illustrates that these indicators are distinctly measuring BDIME, as their interactions with other constructs like BDDMC, CP, CSS, DSM, and ORT are considerably weaker. In the case of Compliance Practices (CP), the indicators (CP1, CP2, CP3) predominantly measure CP with loadings of 0.774 to 0.887, and they show negligible correlations with other constructs, such as a -0.129 with ORT for CP2, supporting strong discriminant validity by indicating that these items do not significantly measure any construct other than CP.

Cloud Scalability Solutions (CSS) indicators (CSS1, CSS2, CSS3, CSS4) primarily load on CSS, with values from 0.801 to 0.881, and show minimal cross-loadings with other constructs, reinforcing that these items are specific to measuring CSS effectively. For Decision Support Management (DSM), the indicators (DSM1, DSM2, DSM3) have high loadings on DSM (0.874 to 0.903) and relatively low loadings on other constructs such as BDDMC, BDIME, CP, CSS, and ORT, indicating robust discriminant validity.

Lastly, Organizational Readiness for Technology (ORT) indicators (ORT1, ORT2, ORT3) are distinctly measuring ORT, with loadings from 0.863 to 0.894, and exhibit minor loadings on other constructs. For instance, ORT2 has a -0.111 with CP, showcasing that ORT indicators are more closely tied to measuring ORT than any other construct in the model. Each measurement indicator in the model demonstrates strong discriminant validity because it shows considerable loading significance for its construct than for any other construct. The solid discriminant validity which emerges from these calculations enables effective and distinct measurement of the constructs for further interpretation and analysis of data management challenges in cloud computing infrastructure.

Table 6
Cross Loadings

	BDDMC	BDIME	CP	CSS	DSM	ORT
BDDMC1	**0.838**	0.465	0.26	0.142	0.342	0.407
BDDMC2	**0.868**	0.513	0.199	0.158	0.365	0.463
BDDMC3	**0.825**	0.478	0.227	0.201	0.313	0.425
BDDMC4	**0.756**	0.399	0.177	0.165	0.249	0.398
BDIME1	0.489	**0.811**	0.081	0.103	0.298	0.381
BDIME2	0.495	**0.836**	0.01	0.17	0.345	0.366
BDIME3	0.376	**0.771**	0.073	0.086	0.293	0.351
CP1	0.258	0.056	**0.887**	0.011	0.01	-0.037
CP2	0.119	0.011	**0.774**	0.028	0.016	-0.129
CP3	0.247	0.079	**0.887**	0	0.063	-0.12
CSS1	0.189	0.159	0.023	**0.881**	0.125	-0.019
CSS2	0.157	0.148	-0.005	**0.836**	0.058	-0.033
CSS3	0.166	0.078	0.038	**0.823**	0.089	-0.044
CSS4	0.159	0.116	-0.022	**0.801**	0.044	-0.007
DSM1	0.336	0.323	0.036	0.104	**0.903**	0.015
DSM2	0.326	0.304	0.059	0.083	**0.874**	0.001
DSM3	0.372	0.4	0.01	0.075	**0.899**	0.071
ORT1	0.466	0.412	-0.037	0.013	0.021	**0.883**
ORT2	0.441	0.389	-0.111	-0.082	0.041	**0.863**
ORT3	0.452	0.398	-0.122	-0.015	0.032	**0.894**

4.1. Measurement Model

The diagram (figure 3) displays the research model which demonstrates data management measurement in cloud computing infrastructure through its operational indicators reflecting construct relationships. The measurement model uses various multiple indicators to assess each construct with Organizational Readiness for Technology, Decision Support Management and Compliance Practices as key elements. This model demonstrates the relational aspects between both constructs which show the potential effects and correspondence patterns. The potential relationship exists between Big Data Decision-Making Capability and Big Data Information Management Effectiveness because improved decision capabilities would boost information management effectiveness for cloud computing applications.

The model contains constructs such as Cloud Scalability Solutions that demonstrate relationships to other elements illustrating their part in cloud infrastructure management processes. Certain model elements are shown to function as mediation variables thus revealing their possible role in connecting decision-making competencies to organizational performance indicators for complete data management evaluation. An overall visual presentation shows how the research theoretical and empirical structure works through the diagram by explaining contributions of model parts toward comprehending cloud computing data management issues.

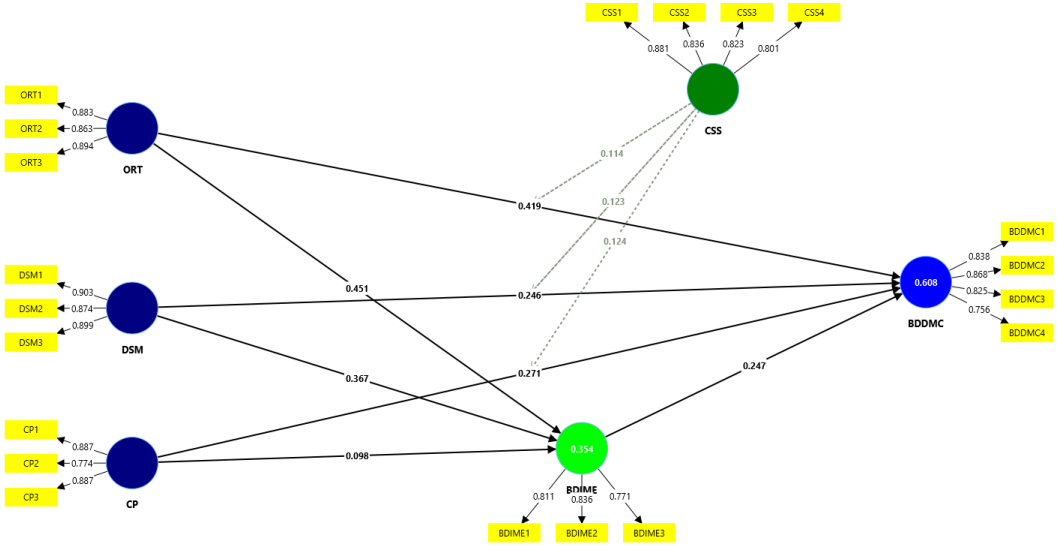


Figure 3: Measurement Model

4.2. Path Analysis

Path analysis results (table 7) deliver thorough information about how different constructs relate to each other in the chosen model framework. Data reveals strong relationships exist between compliance practices and cloud scalability solutions together with decision support management and organizational technology readiness and both big data decision-making capability and big data information management effectiveness. The research shows that BDIME maintains a positive connection to BDDMC suggesting organizations which excel at information management practices will achieve higher levels of informed decision capability. Both big data decision-making capability (BDDMC) and big data information management effectiveness (BDIME) experience direct positive impacts through Compliance Practices (CP).

Table 7
Path Analysis

	Beta	STDEV	T-stats	P values
BDIME -> BDDMC	0.247	0.036	6.881	0.000
CP -> BDDMC	0.271	0.028	9.571	0.000
CP -> BDIME	0.098	0.036	2.693	0.007
CSS -> BDDMC	0.139	0.028	4.959	0.000
DSM -> BDDMC	0.246	0.032	7.665	0.000
DSM -> BDIME	0.367	0.035	10.419	0.000
ORT -> BDDMC	0.419	0.033	12.576	0.000
ORT -> BDIME	0.451	0.031	14.362	0.000
CSS x ORT -> BDDMC	0.114	0.025	4.533	0.000
CSS x DSM -> BDDMC	0.123	0.029	4.195	0.000
CSS x CP -> BDDMC	0.124	0.026	4.685	0.000
CP -> BDIME -> BDDMC	0.024	0.010	2.481	0.013
DSM -> BDIME -> BDDMC	0.091	0.016	5.579	0.000
ORT -> BDIME -> BDDMC	0.112	0.018	6.356	0.000

BDDMC receives positive influence from both Cloud Scalability Solutions (CSS) and Decision Support Management (DSM) which confirms the power of cloud infrastructure scalability together with decision support systems to improve organizational decision capabilities. Organizational Readiness for Technology (ORT) maintains a powerful positive relationship with BDDMC and BDIME because prepared organizations can better utilize technology to enhance their decision-making functions and information management performance. This model demonstrates complex dependencies because Cloud Support Services collaborate with Organizational Readiness for Technology to strengthen Business Decision-Making Capabilities. The collective force of CSS combined with DSM and CP demonstrates strong influence over BDDMC thus demonstrating superior decision-making capacity.

Decision support management working through BDMI leads to indirect contributions toward BDDMC by improving information management effectiveness along with compliance

practices. The analysis shows ORT increases BDDMC directly through BDIME since organizational readiness provides a crucial boost to data management effectiveness levels. These research findings establish the intertwined importance of factors which boosts data management performance and decision-making features found in cloud-based computing systems. All paths demonstrate statistically significant associations which support the solid base for understanding how technology adoptions and management practice improvements directly and indirectly enhance organizational decision-making quality.

4.3. Structural Model

The structural diagram (figure 4) presents visual representation of different organizational and technological relationships. The diagram illustrates ORT with DSM and CP and CSS as contributors for both BDDMC and BDIME.

The model presents Big Data Information Management Effectiveness as a mediating variable because professionals involved in managing big data information contribute significantly to the assessment of organizational readiness together with compliance practices along with decision support and cloud scalability on decision-making capabilities in cloud environments. The configuration demonstrates how information management advances create better decision-making practices.

The model displays interactive effects that demonstrate the complex nature of BDDMC development through CSS with organizational readiness and additional contributing elements. The effectiveness of decision-making depends on combined organizational and technological dimensions which operate together in a synergistic manner.

The structural model demonstrates the systematic flow of organizational capabilities together with standard compliance and choice-making support and cloud solution scalability as they join forces to improve effective data management which produce enhanced decision outcomes within cloud environments. The model displays the interdependent nature of multiple constructs in cloud environments by establishing how they combine to boost data management effectiveness together with decision-making strength in cloud computing frameworks.

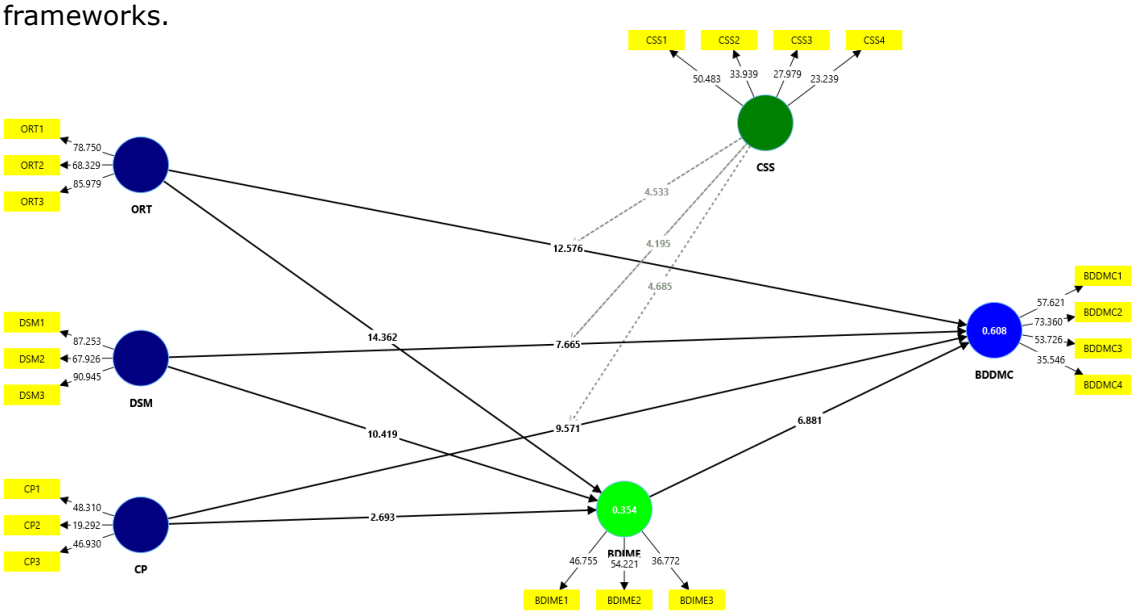


Figure 4: Structural Model

4.4. Discussion

The research findings help clarify multiple factors affecting cloud data management challenges specifically for South African business operations. Research studies (Lokuge et al., 2019; Sharma & Venkatraman, 2023) support the findings that ORT produces positive and significant effects on BDDMC and BDIME. Enterprises that strengthen their IT readiness through better technical abilities alongside leadership dedication and culture development become more effective in managing cloud data for purposeful decision processes.

DSM proved itself as a key predictor for BDIME and BDDMC based on research conducted by Aburub et al. (2024) and Niu et al. (2021). The studies showed that systems which produce fast and reliable decisions fuel better big data implementation. Decision support management functions as a vital organizational structure which connects data infrastructure to strategic initiatives by delivering decision-quality insights from properly handled data collections.

Compliance Practices (CP) stands out as a key component in the organizational framework. The outcomes derived from CP extend beyond risk protection according to Mitchell and Meggison (2014) and Kim and Kim (2017), as these practices strengthen both BDIME and BDDMC through accuracy retention and complete data with regulatory adherence. South African organizations remain increasingly responsible for data governance compliance through international and national cybersecurity regulations.

Cloud Scalability Solutions (CSS) make a robust contribution to BDDMC according to Al-Said Ahmad and Andras (2019) and Fadnavis et al. (2021) explaining how adaptable cloud platforms handle substantial data amounts. Cloud environments give organizations the strategic advantage of scalability through which they can handle rising data processing requirements while delivering reliable high-performance services.

The research discovered that BDIME functions as a moderate factor to connect every independent variable with BDDMC thus supporting previous studies by Shamim et al. (2019) and (Tabesh et al., 2019) that effective big data information management converts base organizational capabilities into useful intelligence. Organizations need accurate integrated time-relevant usable data in addition to their technological capabilities or compliance frameworks to achieve effective data management.

The studies confirm that CSS acts as an enhancer which strengthens outcome values when working together with other constructs. Cloud scalability acts as a moderator to reinforce and enhance direct outcomes while strengthening the organizational factors that affect decision-making between ORT, DSM and CP and BDDMC. Sehgal et al. (2020) expressed in their study that cloud infrastructure stands as the base upon which higher-level data capabilities are constructed.

The findings presented by Ramezani and Nasrollahi (2020) about deep internal implementation of compliance frameworks as opposed to isolated checklist usage receive support from the mediating role of BDIME in the relationship between CP and BDDMC. The combination of regulatory compliance requirements and business intelligence goals finds seamless integration through this approach because it ensures that all data management initiatives serve dual purposes.

This research contributes to Alrawhani et al. (2025) who analyzed banking sector information security compliance by adding a strategic approach through effective data governance that incorporates compliance as an input to decisions. The new perspective transforms compliance from a defensive shield to an intelligence generation system that benefits the organization.

Shamim et al. (2017) backed the notion that leadership focused on knowledge development encourages employees to take data-centred approaches in their work. The key findings from ORT and DSM in our study demonstrate that leadership dedication should pair up with organizational learning processes which equally depend on technological readiness to guide decisions through data evidence.

These results gain additional significance through the South African organizational environment. Growing pressure on enterprises stems from the swift advancement of digital technologies as demonstrated by Hossain et al. (2024) and Nisar et al. (2020). This study fulfills the need by demonstrating a model to understand how cloud computing data management difficulties can be handled through strategic and operational components.

This study also supports earlier research by Naghib et al. (2022) and Al-Ali et al. (2024), who explored the importance of advanced digital technologies, such as IoT and AI,

in managing big data. While our model does not include these technologies explicitly, the strong effects of scalability and readiness suggest that organizations are laying the groundwork for such integrations.

5. Conclusion and Policy Suggestions

The research designed an analysis of complex data management problems in cloud computing infrastructure, especially for South Africa's data management environment. The combination of Organizational Readiness for Technology (ORT), Decision Support Management (DSM), Compliance Practices (CP), and Cloud Scalability Solutions (CSS) together shapes Big Data Decision-Making Capabilities (BDDMC) while the construct Big Data Information Management Effectiveness (BDIME acts as a mediating variable according to the study findings.

The research data shows direct positive relationships exist between BDDMC and each of the four independent variables which indicates big data organizations need proper infrastructure setup and regulatory standards as well as organizational preparedness and flexible cloud systems to develop their decision capabilities. Effective management of data through BDIME makes significant contributions to link the independent variables with decision-making capabilities because it demonstrates why effective data management remains vital before turning data into valuable strategic insights. The significant interaction effects which involve CSS demonstrate that organizations need adaptable cloud infrastructure to make their other organizational capabilities work efficiently.

This research delivers theoretical advancement through a verified detailed model which combines the structural aspects with the technological characteristics of cloud-based data maintenance. The study furnishes concrete recommendations to business executives along with cloud technicians and IT decisionmakers for prioritizing their financial commitment to reach optimal data-based outcomes in cloud infrastructure. These recommendations can also inform South African organizations when adapting cloud governance practices to their own institutional and regulatory environment.

Cloud computing data management challenges require resolution through a strategy that consists of multiple layers that exceed simple technological improvements. The successful implementation of data management in cloud solutions requires organizations with prepared infrastructure and data structures which use decision-support systems through dedicated and scalable infrastructure functions supported by effective information management practices. When companies make their data management elements work together, they become capable of overcoming cloud-based data complexities and reaching better decision performance and digital business advantages.

5.1. Implications of the Study

These results hold important implications for researchers and practitioners alike. For scholars, the study offers a validated model that can be tested across different contexts. For practitioners, it offers clear guidance: investing in organizational readiness, cloud scalability, and compliance frameworks pays dividends not only in regulatory adherence but also in data-driven strategic outcomes. As cloud computing continues to evolve, such integrated models will be crucial in navigating the increasingly complex terrain of big data management.

Author Contributions
Elisha Mutize: Conceptualisation
Admire Mthombeni: Methodology and Literature review
Leonard Chitongo: Results, conclusion and paper editing

Conflict of Interests/Disclosures
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