



Leadership analytics in the AI era: Investigating the impact of data-driven decision-making on employee engagement and organizational performance in South Africa's public sector

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Abstract

Purpose: The study examined the effect of leadership styles on employee performance in public hospitals in Nigeria. Specifically, it investigated how transformational, transactional, and autocratic leadership practices influence healthcare workers' performance outcomes, aiming to provide insights for improving workforce productivity and service delivery.

Methodology/Design: A quantitative research design was employed, using a structured questionnaire administered to 400 healthcare employees across selected public hospitals. Data were analyzed using descriptive statistics, correlation, and multiple regression analysis with SPSS version 26. Reliability and validity of the instrument were confirmed through Cronbach's alpha, and expert review.

Findings: The results revealed that transformational ($\beta = 0.45$, $p = 0.001$) and transactional leadership ($\beta = 0.31$, $p = 0.002$) positively and significantly influence employee performance, while autocratic leadership ($\beta = -0.27$, $p = 0.004$) negatively impacts performance. These findings highlight that participative and motivating leadership approaches are more effective in enhancing staff productivity.

Implications: Hospital management should adopt transformational and transactional leadership practices while minimizing autocratic tendencies. Policymakers should implement leadership development programs and performance-based incentives to improve healthcare delivery.

Originality/Value: The study contributes to the literature by empirically validating Transformational Leadership Theory, Path-Goal Theory, and Contingency Theory within the Nigerian public healthcare context, offering practical guidance for enhancing employee performance in resource-constrained hospitals.

Keywords: Leadership styles, employee performance, public hospitals, transformational leadership, Nigeria

Introduction

The rapid advancement of Artificial Intelligence technologies has transformed organizational leadership practices globally, particularly through the emergence of leadership analytics which is an approach that leverages data-driven insights to enhance decision-making processes (Marler & Boudreau, 2020). In the public sector, where accountability, transparency, and efficiency are paramount, leadership analytics holds significant promise for improving employee engagement and overall organizational performance (Nguyen *et al.*, 2021). South Africa's public sector, characterized by complex bureaucratic structures and ongoing transformation efforts, presents a critical context for investigating how AI-enabled decision-making shapes leadership outcomes (Nienaber & Hough, 2022).

Employee engagement, defined as the emotional and cognitive commitment of employees to their organization, is a vital precursor to enhanced productivity and service delivery in the public sector (Meyer & Gagné, 2019). However, public institutions often grapple with low engagement due to structural inefficiencies and limited resources (Rosenberg & Nienaber, 2020). Integrating leadership analytics can provide leaders with real-time, evidence-based insights into workforce dynamics, enabling tailored interventions that promote motivation, job satisfaction, and retention (Choi & Lee, 2020). This data-centric leadership approach aligns with the principles of New Public Management (NPM), which advocates for adopting private-sector management tools to improve public sector efficiency (Brunetto *et al.*, 2019).

Moreover, organizational performance in the South African public sector remains a concern, with challenges ranging from corruption and skill shortages to inadequate service delivery (Mokhothu & Sutherland, 2021). AI-powered leadership analytics offers opportunities to optimize resource allocation, monitor performance metrics, and predict potential operational risks, thus fostering more agile and responsive public organizations (Van der Merwe & Botha, 2023). Notwithstanding these potential benefits, the adoption of AI and data-driven leadership tools in South Africa's public institutions remains uneven and under-researched (Maree & Lubbe, 2022). This gap underscores the need for empirical studies that assess how leadership analytics affects employee engagement and performance within this unique socio-political landscape.

The integration of AI technologies in leadership aligns with broader digital transformation trends impacting governance globally. Research indicates that data-driven leadership can lead to enhanced decision quality, increased transparency, and more inclusive management practices (Peters & Van Dyk, 2021). However, the success of such initiatives is contingent upon factors including organizational culture, technological infrastructure, and the skill level of public sector leaders (Mukwada & Maphosa, 2020). South Africa's digital divide and varied capacity across government departments necessitate a context-specific understanding of leadership analytics' impact (Sibanda & Matshediso, 2019). Furthermore, leadership analytics intersects with theories of transformational and strategic leadership, emphasizing the role of data-informed vision and follower motivation (Nkosi & Pretorius, 2023). These leadership styles, when

augmented by AI insights, can potentially drive employee commitment and align individual goals with organizational objectives, enhancing public service outcomes (Tshuma & Govender, 2024). The emergent body of literature calls for integrated models that combine technological innovation with leadership theory to explain performance improvements in public sector settings (Khoza & Mafini, 2021).

Hence, this study seeks to bridge the empirical gap by examining the impact of leadership analytics in the AI era on employee engagement and organizational performance specifically within South Africa's public sector. It will contribute to scholarly discourse by situating AI-enabled leadership within the public administration context, offering practical insights for policymakers and public managers striving to harness data-driven decision-making to enhance governance effectiveness.

Research Objectives

The study seeks to explore how data-driven decision-making influenced by AI impacts employee engagement and organizational outcomes, while considering contextual factors unique to the South African public service environment. Specifically, the study seeks to:

1. Evaluate the extent to which leadership analytics is adopted and integrated into decision-making processes within South Africa's public sector institutions;
2. Examine the impact of data-driven leadership analytics on employee engagement levels among public sector employees;

Literature Review: Theoretical Framework

Theoretical Framework

This study is anchored in two complementary theories: Contingency Theory and Systems Theory, each offers unique insights into the dynamics of leadership and organizational functioning in complex environments.

Contingency Theory

Contingency Theory is a foundational organizational theory that posits that there is no single best way to lead, manage, or organize an enterprise; rather, the effectiveness of leadership depends on the alignment or "fit" between the leader's style, organizational structure, and situational variables (Fiedler, 1964). This theory challenges the universalist approach by emphasizing that leadership effectiveness is contingent on the context in which it is exercised, including environmental factors, technology, and internal organizational dynamics.

In the context of leadership analytics and AI-driven decision-making, Contingency Theory provides a useful lens to understand how the adoption and impact of data-driven leadership tools vary across different public sector environments. Leadership analytics systems generate vast amounts of data that can inform strategic and operational decisions, but their effectiveness depends on how well these tools are integrated within the organizational culture, technological infrastructure, and leadership style (Smith & Lewis, 2021). For example, a public institution with a hierarchical culture may face challenges adopting collaborative analytics platforms compared to a more decentralized agency that encourages participative decision-making.

Systems Theory

Systems Theory provides a comprehensive framework for understanding organizations as complex, interconnected entities comprised of multiple interdependent components working together to achieve common goals (Kast & Rosenzweig, 1972). Originating from General Systems Theory developed by Ludwig von Bertalanffy in the mid-20th century, this perspective shifts focus from isolated parts to the whole, emphasizing the dynamic relationships and interactions within an organizational system and between the organization and its external environment (Von Bertalanffy, 1968).

In the context of public sector organizations, Systems Theory is particularly relevant because these institutions operate within intricate networks of stakeholders, regulations, policies, and technological infrastructures. The theory posits that changes in one part of the system inevitably affect other parts, requiring leaders to adopt a holistic approach when implementing new processes or technologies such as leadership analytics (Kast & Rosenzweig, 1972). Leadership analytics initiatives thus cannot be viewed as isolated technological interventions; instead, they must be integrated within the broader organizational system, including human resources, workflows, communication channels, and cultural norms.

Conceptualizing Leadership Analytics

Leadership analytics represents the emerging intersection of leadership practices and advanced data analytics technologies, enabling leaders to make informed, evidence-based decisions that enhance organizational outcomes (Davenport, 2018). It extends traditional leadership by integrating quantitative and qualitative data ranging from employee performance metrics to sentiment analysis into decision-making processes, thereby fostering transparency, accountability, and agility in leadership (Wang *et al.*, 2020). The evolution of leadership analytics parallels the broader digital transformation sweeping across organizations globally. In the public sector context, leadership analytics is increasingly viewed as a strategic tool for addressing complex challenges such as resource constraints, bureaucratic inefficiencies, and stakeholder accountability (Janssen & van der Voort, 2016). The adoption of leadership analytics facilitates evidence-based governance by providing granular insights into employee behavior, organizational climate, and service delivery performance (Meijer, 2019). These insights support data-driven leadership styles that emphasize collaboration, continuous feedback, and adaptive change management (Kane *et al.*, 2019).

Definition and Evolution of Leadership Analytics

Leadership analytics is a specialized branch of organizational analytics that focuses on leveraging data and advanced analytical techniques to enhance leadership decision-making and improve organizational outcomes (Davenport, 2018). It encompasses the systematic collection, analysis, and interpretation of data related to leadership behaviors, employee performance, and organizational processes to support evidence-based leadership practices (Marler & Boudreau, 2017). Unlike traditional leadership approaches that often rely on intuition and subjective judgment, leadership analytics harnesses quantitative and qualitative data, including real-time

dashboards, predictive models, and sentiment analysis, to inform strategic and operational decisions (Wang *et al.*, 2020).

The evolution of leadership analytics reflects broader trends in digital transformation and the rise of big data technologies. Initially, organizational analytics focused primarily on business intelligence and human resource metrics, such as turnover rates and employee satisfaction surveys (Mikalef *et al.*, 2019). In the public sector, leadership analytics is gaining traction as a vital tool for improving transparency, accountability, and service delivery (Janssen & van der Voort, 2016). Public sector leaders face unique challenges, including bureaucratic inertia, resource constraints, and complex stakeholder environments, which demand adaptive and data-informed leadership approaches (Meijer, 2019).

Adoption and Integration of Leadership Analytics in South Africa's Public Sector Institutions

The adoption and integration of leadership analytics in South Africa's public sector remain in the early stages, with significant variation across departments and levels of government. While some institutions have begun to explore data-driven leadership practices, systemic implementation is hindered by infrastructural, cultural, and institutional challenges.

A study by Bruintjies and Njenga (2024) identified seventeen factors influencing big data adoption within a South African government organization, highlighting issues such as resistance to change, lack of technical skills, and inadequate data governance frameworks. Similarly, Botha *et al.* (2023) demonstrated how big data analytics has been adopted for forecasting South African inflation, indicating a growing recognition of data's value in policy-making.

However, the integration of leadership analytics into decision-making processes is less advanced. While tools like Business Intelligence (BI) and Big Data Analytics (BDA) are increasingly utilized for operational insights, their application in strategic leadership contexts remains limited. A study by Fredriksson *et al.* (2017) found that although public sector organizations in developing countries, including South Africa, are adopting BI tools, the use of these tools for leadership decision-making is still emerging.

Institutional readiness is another critical factor. Sibanda *et al.* (2024) assessed the readiness of the South African public sector to adopt blockchain technology and found that factors such as outdated financial reporting systems and lack of legislation pose significant barriers. These findings suggest that similar challenges may impede the adoption of leadership analytics.

Notwithstanding these challenges, there are indications of progress. The establishment of the Local Government ICT Network (SALGA, 2011) and initiatives like MobiSAM (Khene *et al.*, 2021) demonstrate a growing commitment to enhancing digital literacy and citizen engagement, which are foundational for the adoption of leadership analytics.

Conclusively, while there is a nascent interest in leadership analytics within South Africa's public sector, its adoption and integration into decision-making processes are constrained by infrastructural, cultural, and institutional challenges. Addressing these barriers is essential for leveraging data to enhance leadership effectiveness and public service delivery.

Impact of Data-Driven Leadership Analytics on Employee Engagement Levels among Public Sector Employees

The integration of data-driven leadership analytics into public sector management holds significant potential for enhancing employee engagement. Leadership analytics enables leaders to tailor their strategies based on comprehensive insights derived from organizational data, which aligns well with the premises of Contingency Theory. Contingency Theory posits that effective leadership is contingent upon the fit between leadership style and situational variables, including organizational context and employee characteristics (Fiedler, 1964). Data-driven leadership analytics provides the situational awareness required for leaders to adapt their approaches dynamically to optimize employee engagement.

Empirical evidence from South Africa supports the critical role of leadership in fostering engagement. Masuku (2025) found that leadership and learning initiatives drive employee engagement in the public sector, indicating that leadership effectiveness depends on contextual understanding and adaptation. Alabi *et al.* (2024) further underscore that data-driven leadership strategies improve engagement by enabling leaders to respond to employee needs and organizational demands effectively. This responsiveness reflects the core of Contingency Theory, which emphasizes situational fit rather than one-size-fits-all leadership (Alabi *et al.*, 2024).

Moreover, performance management systems serve as key mediators between leadership and employee engagement. Maake *et al.* (2024) highlighted that employment relationships and work engagement significantly influence these systems in South Africa's public sector. Data-driven leadership analytics enhances these systems by providing precise, timely data that informs leadership decisions, enabling adjustments tailored to specific workforce dynamics, as Contingency Theory would advocate.

Culturally specific leadership models like Ubuntu leadership also resonate with this theory. Ubuntu leadership's emphasis on interconnectedness and community aligns with situational factors that data analytics can uncover, allowing leaders to foster higher engagement levels through culturally relevant practices (Mthembu & Mthembu, 2024). Data-driven insights help leaders understand such cultural contingencies and implement adaptive engagement strategies.

In sum, the impact of data-driven leadership analytics on employee engagement can be effectively understood through the lens of Contingency Theory. By leveraging data to tailor leadership approaches to the unique needs and circumstances of public sector employees, leaders can optimize engagement outcomes. This theoretical alignment underscores the value of adopting leadership analytics as a strategic tool in South Africa's public sector.

Empirical Review

Mariani *et al.* (2020) conducted a study on the application of leadership analytics in U.S. federal agencies to investigate how AI-driven decision-making impacts employee engagement and organizational performance. Using a sample of 412 managerial and non-managerial employees across five departments, the study employed a structural equation modeling (SEM) approach. The findings revealed that leadership analytics adoption was positively and

significantly associated with employee engagement ($\beta = 0.46, p < 0.01$) and organizational performance ($\beta = 0.38, p < 0.01$). Employee engagement was found to partially mediate the relationship, suggesting that the benefits of leadership analytics are amplified when employees are more involved and connected to their work. The study concluded that AI-enhanced analytics provide actionable insights that improve decision accuracy and foster a culture of trust, ultimately boosting public sector performance.

Similarly, Chen and Dlamini (2022) conducted a study in Canada examining the role of AI-powered leadership analytics in enhancing data-driven decision-making within provincial government agencies. The research involved 356 participants, including senior managers and policy analysts, and utilized hierarchical regression analysis. Results indicated that the adoption of leadership analytics significantly improved employee engagement scores by 18% and organizational performance indicators by 22% over a 12-month period. The analysis also showed that organizations with strong technological infrastructure experienced stronger effects (interaction term $\beta = 0.31, p < 0.05$), highlighting the moderating role of contextual resources. The authors concluded that leadership analytics in the AI era serves as both a strategic and operational asset, enabling public sector managers to make more transparent and timely decisions.

Also, Schmidt *et al.* (2023) conducted a study in Germany to assess the effects of leadership analytics on employee engagement and organizational performance within federal administrative offices. Drawing on survey data from 287 civil servants and archival performance records, the authors employed partial least squares path modeling (PLS-PM). The study found that leadership analytics adoption had a significant positive impact on employee engagement ($\beta = 0.42, p < 0.01$) and that engagement fully mediated its relationship with organizational performance ($\beta = 0.27, p < 0.05$). Furthermore, the analysis revealed that cultural openness toward innovation strengthened these relationships, consistent with the principles of Systems Theory. The authors concluded that leadership analytics in the AI era not only enhances operational efficiency but also creates an environment conducive to sustained employee motivation in the public sector.

Methodology

Research Design

The study adopts a quantitative research design. The design employs a structured survey administered to a representative sample of public sector employees and managers. This generates empirical evidence on the extent to which AI-enabled leadership analytics predicts employee engagement and organizational performance metrics

Population and Sampling Technique and Sample Size

The population for this study comprises public sector employees and leaders across ministries, departments, and agencies (MDAs) where AI-enabled leadership analytics tools or related decision-support systems have been introduced or piloted. This includes senior executives responsible for strategic decision-making, mid-level managers involved in operational oversight, and frontline staff whose engagement levels are directly influenced by leadership practices informed by AI analytics.

A stratified random sampling technique was employed to ensure proportional representation across organizational levels (executive, middle management, operational staff) and sectors (e.g., health, education, public administration). The sample size of 422 was determined using Cochran's formula for infinite populations, adjusted for a 95% confidence level and a 5% margin of error, ensuring sufficient statistical power for inferential analysis.

Data Collection Methods and Research Instruments

The study employs a structured questionnaire designed to capture respondents' perceptions, experiences, and assessments of leadership analytics and data-driven decision-making practices within their respective institutions. The questionnaire was divided into sections measuring key constructs such as AI adoption in leadership processes, decision-making efficiency and employee engagement. Items were measured using a five-point Likert scale ranging from "strongly disagree" to "strongly agree" to facilitate statistical analysis. The instrument was adapted from validated scales in existing literature (e.g., Mariani *et al.*, 2020; Nguyen & Malik, 2022) and modified to suit the South African public sector context. The questionnaire was administered through both online and paper-based formats to accommodate varying levels of digital access across respondents

Reliability and Validity of the Study

Ensuring the reliability and validity of the study is essential for producing credible, consistent, and generalizable findings. In the quantitative component, reliability refers to the consistency of the research instrument in measuring the intended constructs, while validity concerns the extent to which the instrument accurately captures the phenomena under investigation (Creswell & Creswell, 2023).

Reliability

The internal consistency of the questionnaire was assessed using Cronbach's alpha, with a threshold value of 0.70 or above deemed acceptable for social science research (Hair *et al.*, 2022). Items that fail to meet this criterion were revised or removed to enhance scale reliability. Additionally, test-retest reliability was evaluated by administering the questionnaire to a small sample twice over a two-week interval, ensuring stability of responses over time.

Validity of the Study

Several forms of validity were addressed. Content validity was established by subjecting the questionnaire and interview guide to expert review from academics and practitioners with expertise in AI, leadership analytics, and public sector management, ensuring alignment with the study objectives (Taherdoost, 2022). Construct validity was examined through factor analysis to confirm that questionnaire items appropriately represent the underlying theoretical constructs. Criterion-related validity was assessed by comparing responses with existing measures of leadership effectiveness and organizational performance, where available.

Data Analysis

Quantitative data from the survey was first subjected to data cleaning and coding to ensure completeness and accuracy.

Descriptive statistics, including means, standard deviations, and frequency distributions, were used to summarize respondent demographics and key study variables (Pallant, 2020). Inferential statistics was then conducted using the Statistical Package for the Social Sciences (SPSS) version 27. Pearson’s correlation analysis was applied to examine relationships between data-driven decision-making, and employee engagement.

All participants were provided with a clear explanation of the study’s purpose, procedures, potential risks, and benefits. Written informed consent will be obtained prior to data collection, ensuring that participation is entirely voluntary (Resnik, 2020). Additionally, to protect participant identities, personal identifiers were removed during data transcription and analysis.

Results

Demographic Characteristics of the Respondents

Exploring the demographic characteristics of respondents is essential, as these variables provide context for interpreting the findings and identifying patterns that may influence perceptions of leadership analytics, employee engagement, and organizational performance. The demographic data collected included gender, age, educational qualification, job position, and years of work experience within the public sector.

From the dataset, male respondents (55.9%) slightly outnumbered females (44.1%), indicating a modest gender imbalance within the sampled public sector institutions.

Regarding age distribution, the largest proportion of respondents (38.5%) fell within the 30–39-year range, followed by those aged 40–49 years (25.5%). This indicates that most participants were in their prime working years, characterized by active involvement in managerial and operational responsibilities.

The educational profile of respondents reveals that 44.8% possessed a bachelor’s degree, while 31.3% held a master’s degree. This demonstrates a well-educated workforce capable of engaging with data-driven decision-making tools and interpreting analytic insights for leadership purposes. In terms of job position, operational staff constituted the

majority (45.9%), followed by middle managers (37.1%) and senior executives (17.1%). This distribution suggests that the study captured perspectives across all organizational hierarchies, providing a comprehensive understanding of how leadership analytics influence employees at different levels.

With regard to years of experience, most respondents (37.4%) had between 5 and 10 years of experience, followed by 25.8% with 11–15 years. This reflects a workforce with substantial institutional knowledge and exposure to administrative systems and reform initiatives.

These demographic characteristics suggest that the respondents were diverse, knowledgeable, and well-positioned to provide reliable insights into how leadership analytics and data-driven decision-making influence engagement and organizational performance within South Africa’s evolving public sector.

Reliability and Validity Results for Objective One

The study’s reliability and validity were tested. Reliability was tested using Cronbach’s Alpha, while validity was assessed through construct validity and Content validation procedures, ensuring that conclusions about leadership analytics adoption and integration in the public sector are empirically sound and contextually valid. The reliability test using Cronbach’s Alpha produced a coefficient of 0.872, which surpasses the 0.70 threshold recommended by Hair *et al.* (2022), indicating strong internal consistency among the leadership analytics adoption scale items. This suggests that the measurement instrument was dependable and consistently captured respondents’ perceptions of leadership analytics integration across South Africa’s public institutions. The construct validity test using the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (0.812) and Bartlett’s Test of Sphericity ($p < 0.001$) confirmed the suitability of the data for factor analysis, validating the unidimensionality of the construct. With content validity, experts confirmed item relevance and clarity, supporting theoretical alignment and measurement accuracy (Taherdoost, 2022). Table 1 presents the results

Table 1: Reliability Results for Objective One

Approach	Type of Test / Criterion	Measurement Focus	Test Result / Evidence	Interpretation
Quantitative	Reliability (Cronbach’s Alpha)	Internal consistency of leadership analytics adoption scale (8 items)	$\alpha = 0.872$	Indicates high internal consistency, exceeding the 0.70 benchmark (Hair <i>et al.</i> , 2022).
	Construct Validity (Factor Analysis)	Convergent validity of leadership analytics items	. KMO = 0.812; Bartlett’s Test ($p < 0.001$)	Sampling adequacy confirmed; items significantly loaded on one dominant factor, verifying construct validity
	Content Validity	Expert review of instrument items related to leadership analytics	Feedback from 3 AI and public management experts	Experts confirmed item relevance and clarity, supporting theoretical alignment and measurement accuracy (Taherdoost, 2022).

Source: Field Data (2025)

Objective One: To evaluate the extent to which leadership analytics is adopted and integrated into decision-making processes within South Africa’s public sector institutions

The first objective of the study sought to evaluate the extent to which leadership analytics is adopted and integrated into decision-making processes within South Africa’s public

sector institutions.

The data collected from 422 respondents, comprising senior executives, middle managers, and operational staff was analyzed using descriptive statistics. Mean scores and standard deviations were computed to determine the level of leadership analytics adoption and integration across various indicators. Table 2 presents the results.

Table 2: Results for Objective One

Leadership Analytics Adoption and Integration Indicators	Mean (M)	Standard Deviation (SD)	Interpretation
Leadership analytics tools are widely used in my institution’s decision-making processes.	4.12	0.83	High adoption level
Leadership decisions are increasingly based on data-driven insights rather than intuition.	4.05	0.91	High adoption level
My institution invests in digital systems to support leadership analytics.	3.87	0.95	Moderate to high investment
Leadership teams receive regular training on analytics-based decision-making.	3.78	1.02	Moderate integration effort
Data from analytics are frequently discussed in executive meetings.	4.01	0.89	High integration
Leadership analytics influence policy formulation and strategy execution.	3.94	0.88	Moderate to high influence
There is strong management support for analytics-driven leadership culture.	4.09	0.86	High managerial commitment
Data accessibility and infrastructure support analytics adoption effectively.	3.81	0.93	Moderate adoption support
Overall Mean Score	3.96	0.91	High extent of leadership analytics adoption and integration

Source: Field Data (2025)

The results from Table 2 reveal a generally high level of leadership analytics adoption and integration across South Africa’s public sector institutions, with an overall mean score of 3.96 (SD = 0.91). This suggests that leadership in public entities increasingly relies on data analytics to inform strategic and operational decisions. The highest-rated indicators such as the widespread use of leadership analytics tools in decision-making (M = 4.12) and strong management support for analytics-driven culture (M = 4.09) reflect a growing institutional shift toward evidence-based governance. These findings indicate that public sector leaders are recognizing the strategic value of analytics in enhancing decision quality, organizational transparency, and policy formulation.

The results also show that leadership decisions are becoming more data-driven rather than intuition-based (M = 4.05), suggesting a cultural transition toward analytical reasoning in leadership practices. Furthermore, frequent discussions of analytics data in executive meetings (M = 4.01) imply that analytical insights are increasingly embedded in the organizational decision chain. These findings indicate that South African public institutions are progressively incorporating data analytics into leadership processes to improve efficiency and responsiveness.

However, the relatively lower mean scores on training in analytics-based decision-making (M = 3.78) and data infrastructure support (M = 3.81) highlight persistent challenges related to human capital and technological readiness. This reflects that many African public institutions struggle with limited analytical capacity and inadequate

investment in data systems, which hinders full-scale analytics integration. Additionally, while data-driven leadership enhances accountability and performance, its sustainability depends on continuous digital skill development and supportive institutional infrastructure.

Reliability and Validity Results for Objective Two: To examine the impact of data-driven leadership analytics on employee engagement levels among public sector employees

The study’s reliability and validity were tested. Reliability was tested using Cronbach’s Alpha, while validity was assessed through construct validity and criterion validation procedures.

The employee engagement scale demonstrated excellent internal consistency with a Cronbach’s alpha coefficient of 0.884, exceeding the acceptable threshold of 0.70 (Hair *et al.*, 2022). This high reliability indicates that the items measuring engagement, covering vigor, dedication, and absorption consistently captured employees’ levels of involvement and enthusiasm toward their work.

The factor analysis results further strengthened the construct validity of the instrument, with a Kaiser-Meyer-Olkin (KMO) value of 0.846 and a statistically significant Bartlett’s Test (p < 0.001), confirming sampling adequacy and factorability. Moreover, the criterion validity test yielded a significant positive correlation (r = 0.612, p < 0.001) between leadership analytics adoption and employee engagement, demonstrating that employees in organizations utilizing data-driven leadership approaches reported higher engagement levels. Table 3 presents the results.

Table 3: Reliability and Validity Results for Objective Two

Approach	Type of Test / Criterion	Measurement Focus	Test Result / Evidence	Interpretation
Quantitative	Reliability (Cronbach’s Alpha)	Internal consistency of the employee engagement scale (10 items)	$\alpha = 0.884$	High internal consistency, surpassing the acceptable threshold of 0.70 (Hair <i>et al.</i> , 2022).
	Construct Validity (Factor Analysis)	Convergent validity of employee engagement items	KMO = 0.846; Bartlett’s Test (p < 0.001)	Sampling adequacy confirmed; items loaded strongly on three factors’ vigor, dedication, and absorption supporting construct validity.
	Criterion Validity	Correlation between leadership analytics and employee engagement scores	r = 0.612, p < 0.001	Demonstrates significant positive association, confirming predictive validity.

Source: Field Data (2025)

Objective: Two: Examine the impact of data-driven leadership analytics on employee engagement levels among public sector employees

Objective two aimed to examine the impact of data-driven leadership analytics on employee engagement levels among public sector employees in South Africa. The analysis focused on measuring

employees’ perceptions of how leadership’s reliance on data analytics influences their motivation, trust, communication, and overall commitment to their work. Descriptive statistics, including mean scores and standard deviations, were computed to assess the extent of engagement resulting from analytics-driven leadership practice. Table 4 presents the results.

Table 4: Results for Objective Two: Impact of Data-Driven Leadership Analytics on Employee Engagement (N = 422)

Employee Engagement Indicators	Mean (M)	Standard Deviation (SD)	Interpretation
Leadership analytics enhance my motivation to perform better.	4.08	0.84	High engagement impact
Data-driven leadership decisions make me feel valued in my role.	3.97	0.89	Moderate to high engagement
Analytics-based feedback helps me understand my performance strengths and weaknesses.	4.11	0.80	High engagement benefit
I trust leadership decisions that are backed by analytics data.	4.15	0.77	High trust and engagement
The use of analytics promotes fairness and transparency in employee recognition.	4.02	0.85	High engagement through fairness
Leadership analytics encourage teamwork and collaboration in my department.	3.88	0.93	Moderate to high collaboration impact
Analytics insights are used to identify and reward top-performing employees.	3.91	0.91	Moderate engagement influence
Data-driven leadership fosters open communication between managers and employees.	3.95	0.87	Moderate to high communication engagement
I feel more committed to my work because leadership relies on analytics to guide decisions.	4.06	0.82	High organizational commitment
Leadership analytics contribute to my overall job satisfaction and morale.	4.09	0.79	High engagement satisfaction
Overall Mean Score	4.02	0.85	High level of engagement influenced by data-driven leadership analytics

Source: Field Data (2025)

The results presented in Table 4 demonstrate that data-driven leadership analytics have a strong positive impact on employee engagement within South Africa’s public sector institutions. The overall mean score of 4.02 indicates a high level of engagement, suggesting that the integration of analytics into leadership practices enhances employees’ motivation, trust, and overall satisfaction at work.

Specifically, the findings show that employees strongly agree that leadership analytics enhance motivation (M = 4.08) and clarify performance feedback (M = 4.11), indicating that data-based insights empower employees to understand their strengths and areas for improvement. The highest-rated indicator trust in analytics-backed decisions (M = 4.15) suggests that employees perceive data-supported leadership as credible and fair, leading to increased confidence in management decisions.

Furthermore, fairness and transparency in recognition (M = 4.02) were rated highly, reinforcing the notion that analytics-driven systems help reduce favoritism and enhance procedural justice. However, relatively lower mean scores were observed for team collaboration (M = 3.88) and analytics-driven rewards (M = 3.91), implying that while data use promotes individual motivation, its application in fostering teamwork and equitable reward distribution remains limited.

The above results, therefore affirm that leadership analytics act as a critical enabler of engagement by improving fairness, communication, and trust across hierarchical levels. Nonetheless, the findings highlight the need for public institutions to expand the scope of analytics application beyond individual performance tracking to

include team-based collaboration and reward mechanisms, ensuring a more holistic engagement strategy.

Result Discussions

Objective One: To evaluate the extent to which leadership analytics is adopted and integrated into decision-making processes within South Africa’s public sector institutions.

The findings of this study reveal that leadership analytics adoption within South Africa’s public sector is gaining significant momentum, marking a clear transition toward evidence-based governance. The results, which produced an overall mean score of 3.96 (SD = 0.91), indicate a high level of adoption and integration of leadership analytics in public institutions. This suggests that leaders are increasingly utilizing data-driven insights to inform strategic, administrative, and policy decisions. High-rated indicators such as the use of analytics tools in decision-making (M = 4.12) and management support for analytics culture (M = 4.09) reflect an institutional shift from intuition-led to evidence-led governance.

These findings resonate with Brynjolfsson and McElheran (2022), who noted that data-driven decision-making enhances managerial efficiency and accountability by enabling leaders to make more objective and timely choices. Similarly, Wamba *et al.* (2020) found that analytics adoption in public organizations strengthens transparency, reduces uncertainty, and facilitates data-backed strategic planning. The current results confirm that South African public institutions are aligning with this global trend, demonstrating growing appreciation for analytics as a vital component of modern leadership.

Furthermore, the results show that leadership decisions are becoming increasingly data-dependent rather than instinct-based ($M = 4.05$), signaling a gradual but meaningful cultural shift toward analytical reasoning. Frequent discussions of analytics insights during executive meetings ($M = 4.01$) reinforce the institutionalization of analytics as part of strategic leadership processes. This aligns with Mandinach and Schildkamp (2021), who argued that organizations that embed analytics into leadership discourse develop more agile and responsive decision-making structures.

However, the study also highlights challenges inhibiting the full realization of analytics-driven leadership. Lower mean scores for analytics training ($M = 3.78$) and data infrastructure support ($M = 3.81$) reveal ongoing capacity gaps and infrastructure limitations. These findings are consistent with Nkohla and Van der Waldt (2023), who identified skill shortages and inadequate technological systems as major barriers to analytics integration in African public sectors. Similarly, Kitchin (2021) emphasized that while many governments are embracing analytics, limited digital literacy and fragmented data systems remain persistent obstacles to adoption.

The qualitative results complement these findings by offering deeper insights into the lived experiences of public sector employees and leaders. Four key themes emerged: (1) Emergence of a Data-Driven Leadership Culture, (2) Partial Integration of Analytics, (3) Capacity and Infrastructure Limitations, and (4) Organizational Resistance and Cultural Shifts.

These findings demonstrate that leadership analytics adoption in South Africa's public sector is well underway, characterized by strong leadership commitment and growing cultural acceptance of data-driven practices. Nonetheless, the journey toward full integration remains constrained by uneven capacity, technological limitations, and organizational resistance. Consistent with prior empirical evidence, the study underscores that sustainable analytics-driven governance requires not only technological investment but also the cultivation of analytical competencies and a supportive organizational culture that embraces continuous learning and transparency.

Objective Two: Examining the Impact of Data-Driven Leadership Analytics on Employee Engagement Levels among Public Sector Employees

The results of this study empirically demonstrate that data-driven leadership analytics significantly enhance employee engagement within South Africa's public sector institutions. The high overall engagement means ($M = 4.02$) indicates that employees perceive leadership analytics as a transformative tool that improves motivation, trust, and fairness in decision-making. This finding aligns with the growing body of literature emphasizing that data-informed leadership fosters psychological empowerment and work commitment among employees (Nguyen *et al.*, 2021; Mikalef *et al.*, 2022).

The study found that trust in analytics-backed decisions ($M = 4.15$) and clarity in performance feedback ($M = 4.11$) were the strongest predictors of engagement. This suggests that employees are more likely to feel valued and motivated when performance evaluations and managerial decisions are supported by transparent and verifiable data. Prior studies by Brynjolfsson and McElheran (2022) and Yoon and

George (2020) similarly revealed that the use of analytics in leadership processes enhances organizational transparency, which in turn boosts employee engagement and morale. In contexts where subjective judgment previously dominated managerial assessments, analytics have proven to introduce a sense of procedural justice and trust, both of which are essential precursors to engagement (Sharma & Mithas, 2020).

The high ratings on fairness and transparency in recognition ($M = 4.02$) reinforce this empirical trend. Employees interpret analytics-based recognition as impartial and equitable, reducing perceptions of favoritism. This aligns with Kaiser and Schmid's (2019) assertion that when data-driven mechanisms replace arbitrary evaluations, employees experience greater trust in leadership and an increased willingness to contribute. Conversely, lower mean scores for team collaboration ($M = 3.88$) and analytics-driven rewards ($M = 3.91$) indicate areas where data integration has not yet translated into collective engagement outcomes. This partial application of analytics may limit its potential to foster cross-departmental collaboration and inclusive reward systems an observation supported by Wamba *et al.* (2020), who argue that while analytics improve individual performance tracking, its strategic use for group cohesion and innovation often lags behind.

This empirical evidence from this study confirms that data-driven leadership analytics significantly influence employee engagement by enhancing fairness, trust, and communication. These findings are consistent with prior studies that emphasize the critical role of analytics in shaping modern leadership and workforce dynamics (Brynjolfsson & McElheran, 2022; Wamba *et al.*, 2020; Nguyen *et al.*, 2021). However, the results also highlight the need for public sector institutions to broaden the use of analytics to include team-based collaboration and reward frameworks, thereby ensuring a holistic and sustainable model of employee engagement.

Conclusion

The study assesses the impact of leadership analytics on employee engagement and organizational performance in South Africa's public sector institutions. The study employed a quantitative surveys design to investigate the adoption, integration, and effects of leadership analytics in public sector organizations.

The findings for Objective One reveal that leadership analytics is increasingly adopted and integrated into decision-making processes within South Africa's public sector, with an overall mean score of 3.96 ($SD = 0.91$). Quantitative results indicate that leaders are progressively relying on data analytics to guide strategic and operational decisions, as evidenced by high scores for the use of analytics tools in decision-making ($M = 4.12$) and strong management support for an analytics-driven culture ($M = 4.09$). Leadership decisions are becoming more data-driven rather than intuition-based ($M = 4.05$), and frequent discussions of analytics in executive meetings ($M = 4.01$) suggest that data insights are increasingly embedded in organizational decision-making. Despite these advances, relatively lower scores for analytics training ($M = 3.78$) and data infrastructure support ($M = 3.81$) highlight ongoing challenges related to human capital development and technological readiness, indicating that full-scale adoption requires sustained investment in skills and systems.

For Objective Two, the findings indicate that data-driven leadership analytics has a substantial and positive impact on employee engagement, reflected by an overall mean score of 4.02. Quantitative results demonstrate that analytics-driven leadership enhances motivation ($M = 4.08$), clarifies performance feedback ($M = 4.11$), and fosters trust in management decisions ($M = 4.15$), suggesting that employees perceive data-informed leadership as credible, fair, and empowering. Fairness and transparency in recognition were also highly rated ($M = 4.02$), reinforcing the role of analytics in promoting procedural justice. Lower scores in team collaboration ($M = 3.88$) and analytics-driven rewards ($M = 3.91$) indicate that while analytics strengthens individual engagement, its potential to enhance collective performance and equitable reward distribution remains underutilized.

Recommendations

Based on the findings of this study, several actionable recommendations are proposed to enhance the adoption and effectiveness of leadership analytics in South Africa's public sector institutions:

1. **Strengthen Leadership Analytics Training and Capacity-Building:** Public sector institutions should prioritize continuous training programs to enhance leaders' analytical skills and data literacy. Developing competencies in interpreting, applying, and communicating insights from leadership analytics will ensure that decision-making is consistently evidence-based and aligned with organizational goals. Mentorship programs and workshops can help bridge the gap between technical and managerial staff, fostering a data-driven leadership culture.
2. **Invest in Quality Technological Infrastructure:** Institutions should allocate resources to upgrade IT systems, integrate digital platforms, and maintain high-quality data management processes. Reliable technological infrastructure is crucial for seamless analytics adoption, enabling timely access to accurate information and supporting collaborative decision-making across departments. Investments in data dashboards, reporting tools, and cloud-based systems will enhance performance monitoring and responsiveness.
3. **Institutionalized a Data-Driven Organizational Culture:** Leadership should actively promote a culture that values transparency, evidence-based decision-making, and innovation. By embedding analytics in everyday practices, encouraging open dialogue around data, and rewarding employees for informed decision-making, institutions can foster trust, engagement, and accountability. Change management initiatives should address cultural resistance by demonstrating the benefits of analytics and celebrating success stories.
4. **Expand Analytics to Team-Based Collaboration and Reward Mechanism:** While leadership analytics currently improves individual performance and engagement, its potential in promoting teamwork and

equitable rewards remains underutilized. Public sector organizations should integrate analytics into team performance assessments, recognition systems, and collaborative projects to ensure a holistic approach to employee engagement and productivity.

Limitations and Suggestions for Future Studies

While this study provides valuable insights into the role of leadership analytics in enhancing employee engagement and organizational performance in South Africa's public sector, several limitations should be acknowledged.

First, the research was limited to selected public institutions, which may restrict the generalizability of the findings across the broader public sector. Future studies could expand the sample to include a more diverse range of institutions across different administrative levels and regions to enhance representativeness.

Second, the study's cross-sectional design limits the ability to infer causality between leadership analytics, engagement, and performance outcomes. While the associations are significant, they do not conclusively establish cause-and-effect relationships. Future research could adopt a longitudinal design to track changes in analytics adoption, engagement, and performance over time, providing deeper insight into the causal dynamics of these relationships.

Third, the reliance on self-reported survey data and interviews may introduce bias, as respondents might have overstated their organization's level of analytics integration or performance to align with perceived best practices. Future studies could triangulate findings using objective organizational data, such as performance metrics, analytics usage logs, and independent assessments, to strengthen validity.

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