

Comparative Analysis of Business Intelligence Adoption in Ten Developing African Economies

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Abstract

This study examines cross-national differences in Business Intelligence (BI) adoption among ten developing African countries, focusing on the impact of national infrastructure, digital readiness, and sectoral dynamics on adoption patterns. While global research recognizes BI as a key driver of data-driven decision-making and competitive advantage, there is limited research on how adoption rates vary across African settings characterized by diverse institutional and economic conditions (Wamba et al., 2017). This research addresses that gap using country-level descriptive data, sector comparisons, and insights from Chapter 4 of the dissertation dataset. The study employs comparative descriptive analysis, country-by-sector means, and cross-national charts to reveal significant variations in BI adoption across the ten economies. Countries with advanced ICT infrastructure, such as Kenya, Rwanda, and South Africa, exhibit higher adoption rates, whereas others experience slower adoption due to infrastructure gaps, regulatory challenges, or skill shortages (Egala et al., 2024). Sectoral analysis indicates that the finance and technology industries are leading in BI implementation, while the retail sector displays more moderate or incremental adoption. The findings underscore the need for tailored, country-specific digital transformation initiatives across the continent. They highlight that BI adoption is influenced not only by organizational capabilities but also by broader national factors that either facilitate or hinder technological progress. This study advances academic debate, informs policy aligned with the African Union Digital Transformation Strategy (AU, 2020), and helps multinational corporations and investors assess market readiness within Africa's evolving digital landscape.

Keywords

Business Intelligence (BI), BI Adoption, Digital Transformation

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1. Introduction

The rapid development of Business Intelligence (BI) technologies has transformed how companies worldwide gather, analyze, and utilize data for informed strategic decision-making. In Africa, the adoption of BI systems varies significantly, influenced by differences in digital infrastructure, regulations, and economic priorities (Elbashir et al., 2008). Despite growing interest in digital transformation, there is limited research on how BI adoption differs across developing countries in Africa. This gap hinders governments and companies from creating tailored digital strategies that fit local contexts.

A cross-national approach is crucial for understanding how structural and institutional differences influence BI adoption. Research on technology adoption indicates that a country's ICT infrastructure, regulatory environment, and socio-economic development affect digital readiness (Tornatzky & Fleischer, 1990). This study compares ten African economies, moving beyond single-country or organization-focused perspectives to provide a broad view of BI adoption across the continent. It also emphasizes industry differences that shape adoption patterns.

This study aims to examine how BI adoption varies among these ten developing African economies and to identify the local factors that explain these differences. Using descriptive data, sector-specific averages, and comparative charts, it provides evidence-based insights to address gaps in the existing literature on technology adoption in Africa. The findings help scholars and practitioners, including policymakers, investors, and development agencies, accelerate digital transformation driven by BI across Africa.

In this study, BI maturity indicates how consistently firms within a particular industry use Business Intelligence tools, data architecture, and analytical processes in their daily decision-making. BI maturity is measured empirically by the average score on a multi-item 5-point Likert scale (1 = strongly disagree to 5 = strongly agree) that evaluates perceived BI use, analytics-driven decision support, and supporting data systems. For interpretive analysis, sector-country cells with mean BI scores of 4.00 or higher are classified as high-maturity, scores between 3.70 and 3.99 as moderate-maturity, and scores below 3.70 as low-maturity. These thresholds act as descriptive benchmarks rather than strict cut-offs, enabling the categorization of countries and industries into high, moderate, and low BI adoption groups for further analysis, as shown in the **Appendix**.

2. Research Purpose

This study compares BI adoption in the Technology, Finance, and Retail sectors across ten emerging African economies: Cameroon, Ghana, Kenya, Nigeria, Namibia, Rwanda, South Africa, Senegal, Uganda, and Zambia. It aims to identify differences, categorize countries by BI maturity levels, and analyze how technological capacity, organizational skills, and environmental factors influence adoption. Sector-specific BI scores and cross-country patterns will be visualized using

heatmaps. Guided by the Technology-Organization-Environment (TOE) framework and supported by the Resource-Based View (RBV), this research seeks to provide detailed insights into the factors that both align with and hinder BI adoption in emerging economies.

3. Research Questions

RQ1: How does BI use vary among the Technology, Finance, and Retail sectors in the ten African economies studied? This question examines industry differences and identifies which sectors are more or less advanced in BI.

RQ2: How do BI adoption levels vary across these countries, and which nations exhibit the highest and lowest levels of BI integration? This question explores national strengths, weaknesses, and disparities within digital ecosystems.

RQ3: How do technological readiness, organizational capability, and environmental factors collectively affect BI adoption patterns at both sector and country levels? This analysis connects findings to the TOE and RBV frameworks, emphasizing enablers and barriers.

RQ4 (Optional but Recommended): What BI maturity groups emerge across nations and industries, and how can these groups help guide digital transformation strategies in African developing countries? This complements the heatmap and provides insights into different adoption patterns.

4. Study Objectives

Objective 1: To evaluate and compare BI adoption levels across the Technology, Finance, and Retail sectors in ten African countries, using validated sector-specific BI indicators.

Objective 2: To analyze international differences in BI adoption and classify countries as high, medium, or low digital maturity based on empirical BI ratings.

Objective 3: To assess how technology readiness, organizational capabilities, and environmental factors affect BI use, using the TOE and RBV frameworks.

Objective 4: To create a heatmap that displays sectoral and cross-national BI trends, emphasizing maturity groups and differences.

Objective 5: To offer evidence-based policy recommendations and digital transformation strategies tailored to each sector and country.

5. Significance of the Study

This research is important because it provides one of the few comparative analyses of BI adoption across different African developing economies. Unlike earlier studies that focus on individual organizations or specific sectors, this work offers a broad cross-national perspective based on country-level data. It shows how national factors—such as ICT policies, infrastructure, education, and innovation systems—influence BI maturity.

The outcomes are valuable for governments, international businesses, and development agencies. Understanding cross-country differences helps create more

targeted interventions aligned with each nation's digital capabilities and goals. The study also supports initiatives like the African Union's Digital Transformation Strategy by providing evidence to promote digital harmonization, capacity building, and economic integration. Overall, it highlights opportunities and challenges for expanding BI-driven operations throughout Africa.

6. Literature Review

Business Intelligence (BI) has become essential for enhancing decision-making, operational efficiency, and competitiveness worldwide. Early research focused on data storage and reporting; however, more recent studies have highlighted the strategic role of BI in predictive analytics, customer insights, and real-time support (Wamba et al., 2017). As companies digitize, BI solutions are increasingly vital for creating value by leveraging both structured and unstructured data to improve performance. In African economies, the Finance and Technology sectors often lead Business Intelligence implementation, while the Retail sector advances more slowly due to resource limitations, fragmented supply chains, and uneven digitalization. This growth emphasizes the need to understand BI development across countries and industries, especially in emerging economies where digital ecosystems are rapidly evolving but unevenly developed.

Despite the global spread of BI, studies show that emerging economies experience slow, uneven adoption due to infrastructure, budgetary, and institutional challenges (Egala et al., 2024). Limited broadband access, a shortage of analytics experts, and inconsistent ICT investment hinder firms—especially SMEs—from fully adopting BI. Research in Africa highlights ongoing issues in data governance, system interoperability, and the development of an analytics culture (UNCTAD, 2021). As a result, BI adoption varies significantly across countries and sectors, reflecting differences in technological readiness and expertise.

Sector-specific factors significantly influence BI adoption outcomes. Studies indicate that technology-intensive industries tend to lead in BI integration, fueled by stronger ICT capabilities and data-driven cultures (Wamba et al., 2017). The finance industry is known for its advanced BI use, driven by regulatory requirements, fraud detection, and risk management. Retail often lags due to fragmented supply chains, limited digitization at points of sale, and weaker analytical capabilities. These differences highlight the importance of examining BI adoption from an industry-specific perspective, accounting for the industry's structure, competition, and the strategic value of data.

Cross-national research shows a strong connection between BI adoption and a country's digital readiness, institutional quality, and innovation ecosystem. Countries with robust ICT infrastructure, supportive e-government policies, and skilled human capital tend to have higher BI maturity (UNCTAD, 2021). Countries like South Africa, Kenya, and Rwanda excel due to ongoing investments in broadband infrastructure, digital skills development, and innovation hubs. Conversely, slower digital progress in some economies leads to greater disparities in BI adoption.

The Technology-Organization-Environment (TOE) framework is widely used to understand BI adoption across sectors and countries. TOE suggests that BI readiness depends on technology infrastructure, organizational capacity, and external factors such as regulation and competition (Tornatzky & Fleischer, 1990). Along with the Resource-Based View (RBV), which argues that organizations and countries gain a competitive advantage through unique, valuable analytical skills (Elbashir et al., 2008), these theories help explain the variation in BI adoption. They demonstrate that technological and organizational capabilities vary significantly in scope and importance across African contexts.

While recognizing the strategic value of BI, current research rarely combines sectoral and national comparisons using actual cross-national data in Africa. Most studies focus on single countries or specific sectors, leaving gaps in understanding how BI maturity evolves in different settings. This report fills that gap by offering a comprehensive, sector-specific, cross-national analysis of BI adoption among ten African economies, using data on Technology, Finance, and Retail, and employing heatmaps and clusters to reveal patterns.

7. Data Description/Dataset Overview

The dataset used in this analysis is drawn from the author's PhD dissertation and is among the most comprehensive cross-national datasets on business intelligence adoption for African developing economies. It contains certified BI ratings for the Technology, Finance, and Retail sectors across ten countries: Cameroon, Ghana, Kenya, Nigeria, Namibia, Rwanda, South Africa, Senegal, Uganda, and Zambia. The data are collected at the sector level using Likert-scale business intelligence models administered to senior managers and individuals knowledgeable about organizational analytics processes.

Three key sectoral variables—Technology BI Adoption, Finance BI Adoption, and Retail BI Adoption—serve as the primary measures for analysis, as further described in the **Appendix**. Each variable was evaluated using multiple questions with proven reliability (Cronbach's $\alpha > 0.70$), ensuring valid and internally consistent results (Wamba et al., 2017). The dataset provides sector-specific averages for each country, allowing for direct international comparisons. The ratings reflect organizational views on BI usage, decision-support effectiveness, data analytics infrastructure, and strategic BI integration.

The survey that forms the basis of this study was conducted from April 2025 to September 2025 across ten African developing economies included in the analysis. Approximately 300 respondents participated, with country-specific sample sizes ranging from 28 to 30 participants per country. In each country, the sectoral subsamples included about 9 to 11 respondents per sector, covering Technology, Finance, and Retail. This distribution ensured that each country-sector group contained enough observations to calculate statistically reliable mean BI adoption scores while also capturing the broad organizational diversity initially documented in the dissertation dataset. The study improves methodological transparency and

replicability by clearly specifying the data-collection period and approximate sample sizes for each country and sector category. This level of detail helps future researchers understand the observed BI maturity patterns with precise empirical evidence, rather than viewing them as abstract, generalized metrics.

Before visualization and analysis, data were checked for consistency to ensure comparability across nations and sectors. Descriptive statistics reveal that Technology consistently scored the highest across countries (around 4.00 - 4.25), followed by Finance (3.75 - 4.00), and Retail (3.58 - 3.85). These industry metrics were used in a heatmap to highlight BI maturity clusters and international differences. The dataset's structure—uniform across sectors and standardized between countries—provides a reliable basis for the comparative analysis discussed in the Results and Discussion sections.

8. Theoretical Contributions

This research advances theoretical understanding by extending the Technology-Organization-Environment (TOE) framework to a cross-national context in Africa. Previous studies have mainly applied the TOE framework at the organizational level, often overlooking differences across national environments (Tornatzky & Fleischer, 1990). This study examines how environmental factors vary across 10 countries and demonstrates that national conditions—such as ICT policies, governance quality, market competition, and digital policies—significantly influence BI adoption. This study shows that the patterns of Business Intelligence (BI) adoption are strongly related to differences in national conditions—such as ICT regulations, governance quality, market competition, and digital policies—across ten countries, rather than solely due to firm-level factors.

The research also advances Resource-Based View scholarship by demonstrating that internal organizational capabilities alone cannot explain adoption when external enabling factors are absent (Barney, 1991). The differences between countries suggest that the success of BI technologies depends on supportive national infrastructure, digital readiness in all sectors, and the availability of skilled human resources. This implies that the RBV should be considered alongside broader environmental constraints in developing economies.

Furthermore, the study contributes to the literature on African digital transformation by providing empirical evidence that contextual complexity must be incorporated into technology adoption theories in the region. The findings indicate that African economies follow distinct digital pathways, shaped by historical, regulatory, and infrastructural factors (Egala et al., 2024). This adds a new dimension to theoretical models, highlighting that digital adoption should consider macro-environmental variability and sectoral diversity.

9. Conceptual Framework

This study's conceptual model examines how national environmental conditions and organizational readiness interact as key factors affecting BI adoption. Using

the TOE framework, it highlights technology availability, organizational capacity, and environmental pressures as interconnected elements (Tornatzky & Fleischer, 1990). These components influence adoption differently across the ten African countries, creating diverse profiles that reflect each nation's developmental stage and digital ecosystem.

Sectoral differences are incorporated into the framework as mediating variables that affect how national conditions lead to adoption outcomes. For instance, financial organizations may adopt BI earlier due to legal requirements for accurate reporting and risk management, whereas the retail sectors may face resource or policy constraints. The model shows how industry-specific drivers interact with national readiness to influence BI adoption results.

The model presents BI adoption as a multi-layered process, with national infrastructure serving as the foundation, sector capabilities acting as the enabling layer, and organizational preparedness influencing the final adoption outcomes. This layered framework captures the complexity of digital ecosystems in emerging regions and provides a systematic perspective on cross-national differences. The study examines how improvements in digital infrastructure and governance can boost BI maturity across African economies.

This conceptual framework demonstrates that a complex mix of technology readiness, organizational capabilities, and environmental factors influences BI adoption across 10 developing African countries. Supported by the TOE paradigm, it also considers sector-specific dynamics that shape how different sectors—such as Technology, finance, and retail—convert national resources into BI utilization. The model illustrates these multiple effects, explaining the significant differences in BI adoption across countries and sectors, and provides a structured basis for comparative analysis.

The conceptual framework shown in **Figure 1** below employs a multi-layered TOE-RBV perspective to analyze differences in Business Intelligence (BI) adoption across the Technology, Finance, and Retail sectors in 10 developing African economies. The diagram acts as an analytical tool rather than a causal model, highlighting how macro-level environmental factors, combined with sector-specific technical readiness and organizational capacity, influence observable patterns of BI maturity. The step-by-step process—from national infrastructure and regulatory frameworks to sectoral BI adoption rates and grouping countries into high, moderate, and low maturity clusters—offers a clear and robust framework for understanding disparities in how countries implement business intelligence. This comprehensive approach helps readers recognize that BI adoption is not merely an organizational decision but a result of interconnected contextual, institutional, and sectoral factors, aligning empirical findings with the theoretical foundations of the Technology-Organization-Environment framework and the Resource-Based View.

The National Environmental Context, at the top of the framework, serves as the foundational layer derived from the “Environment” dimension of the TOE model. It assesses regulatory stability, digital policies, market competitiveness, and na-

tional ICT infrastructure, which together influence the environment for organizational operations. Countries with strong broadband adoption, progressive ICT legislation, and thriving innovation ecosystems—such as Rwanda, Kenya, and South Africa—generally create favorable conditions for BI integration. When these macro-level factors align with national digital transformation goals, businesses are better positioned to adopt analytics-driven decision-making. While this influence does not directly lead to increased BI usage, it is associated with greater national readiness, increasing the likelihood of successful BI projects, particularly in data-intensive sectors.

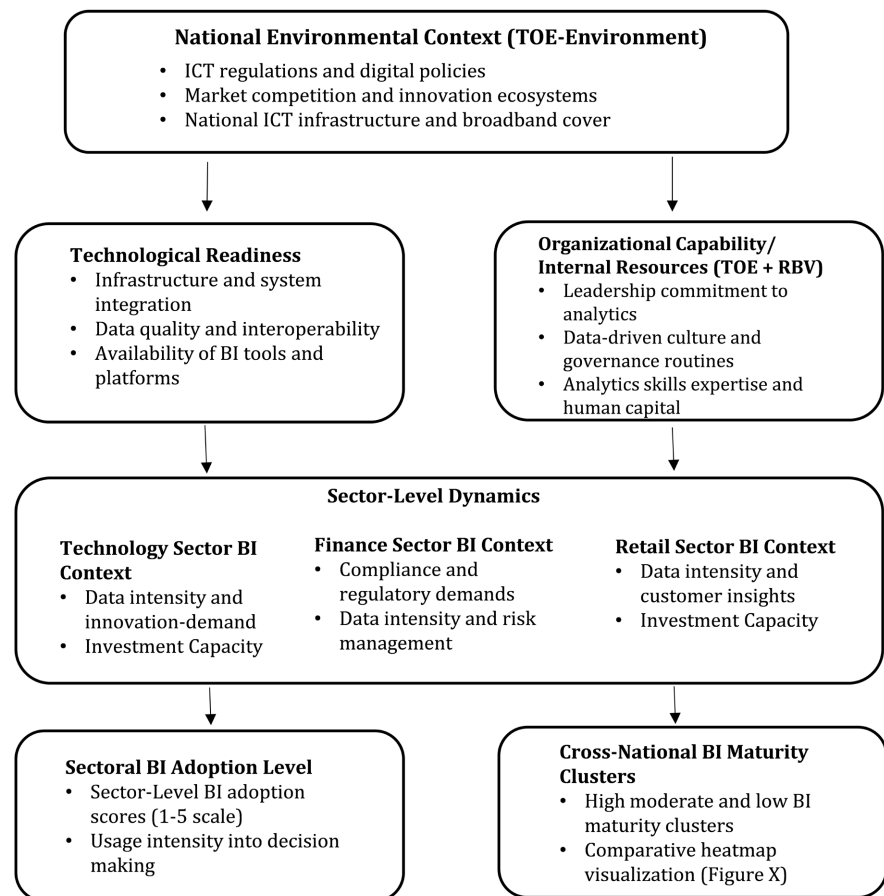


Figure 1. Multi-level TOE-RBV conceptual framework for BI adoption across technology, finance, and retail sectors in the African developing economies.

The second layer covers technical readiness and organizational capability/internal resources, demonstrating the combined effect of the Technology-Organization-Environment (TOE) framework and the Resource-Based View (RBV). Technological readiness emphasizes the quality of infrastructure, system integration, data interoperability, and access to business intelligence platforms, while organizational competence highlights leadership commitment, data governance, analytical skills, and human resources. These internal features align with the Resource-Based View's assertion that competitive advantage arises from valuable, rare, in-

imitable, and non-substitutable internal resources. Organizations with strong BI leadership, clear governance frameworks, and skilled analytics professionals generally achieve higher adoption scores, especially in the Finance and Technology sectors, where regulatory and innovation pressures increase the need for data-driven transformation. The relatively moderate performance of the Retail sector can be linked to weaker resource alignment, indicating that adopting Business Intelligence depends more on capacity building than just technology access.

The third and fourth layers show how sector-specific dynamics influence BI adoption outcomes, producing Country-Sector BI adoption scores and cross-national maturity clusters. In the Technology sector, the need for analytics is linked to the level of innovation and system integration. In Finance, adoption relates to compliance requirements, risk assessments, and digital transaction systems, making it one of the highest-performing sectors. Conversely, the Retail industry, despite having abundant transactional data, often faces capital constraints and needs improved customer analytics frameworks to achieve full BI maturity. These sectoral interactions affect measurable levels of BI adoption, as reflected in average scores on a 1 - 5 scale. The process ends with grouping countries into high, moderate, or low BI maturity clusters, shown in the comparison heatmap and explained in the **Appendix**. This final step highlights that BI performance varies not because of an inherent ability of a sector or country to drive change, but because adoption patterns reflect differences in environmental conditions, sector readiness, and internal capabilities, reinforcing the descriptive and correlational nature of this study.

10. Methodology

This study used a comparative, descriptive approach to analyze differences in BI adoption among the Technology, Finance, and Retail sectors across ten emerging African economies. This methodology was appropriate because the goal was to identify cross-national differences, sectoral variations, and BI maturity clusters rather than establish causal relationships (Creswell & Creswell, 2018). The analysis employed aggregated sector-level averages from national samples, enabling comparisons of BI adoption levels across sectors and countries. This systematic, data-driven approach aimed to deepen understanding of how BI adoption varies across different economic and institutional contexts.

Data originated from the researcher's extensive dissertation dataset, specifically validated sector-level BI scores for Technology, Finance, and Retail in each country. These scores, obtained from multi-item Likert scales with demonstrated reliability, supported robust cross-sector comparisons (Wamba et al., 2017). The ten countries—Cameroon, Ghana, Kenya, Nigeria, Namibia, Rwanda, South Africa, Senegal, Uganda, and Zambia—were chosen for their representation in the comprehensive African BI dataset. The analysis included descriptive statistics, sectoral averages, and a heatmap visualization to examine sectoral and cross-national differences. The heatmap provided a clear visual of BI trends, emphasizing country-

sector relationships consistent with digital maturity frameworks (UNCTAD, 2021).

This publication presents sector-level BI adoption scores that serve as an operational link between empirical data and the TOE and RBV frameworks. At the technological level (TOE), factors influencing each sector's BI adoption score include the availability of ICT infrastructure, data system integration, and the extent to which digital technologies support decision-making within businesses. At the organizational level, these components reflect leadership's commitment to analytics and a data-driven culture, and to employees' skills in utilizing BI outputs, thereby highlighting internal capabilities that the Resource-Based View identifies as valuable, scarce, and difficult to replicate. The environmental context dimension of the TOE framework is represented through cross-national comparisons, evaluated against secondary indicators of national digital readiness, including ICT infrastructure, regulatory frameworks, and innovation ecosystems, sourced from UNCTAD (2021) and the African Union's Digital Transformation Strategy. Instead of estimating causal models, the study uses theoretically grounded mappings to analyze how differences in BI adoption scores among the Technology, Finance, and Retail sectors relate to variations in technological readiness, organizational capacity, and national environmental conditions.

Reliability and validity were preserved through the use of validated measurement tools and standardized scoring methods across all countries. Ethical standards were maintained by using anonymized, aggregated data, avoiding personally identifiable information, and adhering to established research ethics guidelines (Bryman, 2016). This methodological approach ensures the findings accurately represent cross-national and sector-specific BI adoption patterns while reducing human-subject risks. The use of descriptive statistics, visualization, and sector comparisons enhances the study's rigor and provides a strong basis for interpreting the heatmap results. Due to this descriptive, cross-sectional design, all observed relationships are considered associations rather than causal effects, and the findings aim to identify patterns and clusters rather than to develop predictive or explanatory models.

11. Results

The heatmap reveals apparent sectoral differences in BI adoption across the ten African economies, with Technology consistently leading (Figure 2). Tech scores range from 3.97 in Zambia to 4.25 in South Africa, reflecting strong technological capacity and digital integration. The Finance sector closely follows, with scores ranging from 3.75 to 4.00, indicating a reliance on data-driven decision-making, regulatory compliance, and effective reporting systems (Wamba et al., 2017). Retail shows the lowest adoption levels, with scores ranging from 3.58 to 3.74, indicating ongoing challenges such as digital literacy gaps, limited resources, and fragmented data ecosystems. These results align with existing research, which shows that sectors with higher ICT readiness tend to adopt BI more actively than re-

source-heavy or consumer-focused sectors in developing countries (Egala et al., 2024).

Comparisons across countries reveal that South Africa, Rwanda, Kenya, and Uganda generally have higher BI scores across all sectors. These nations have Tech scores above 4.10 and Finance scores above 3.89, demonstrating stronger digital infrastructure, policy focus, and analytical capacity. Countries such as Cameroon, Ghana, and Zambia tend to have moderate adoption levels, particularly in Retail, where scores are below 3.62. These differences highlight the importance of national ICT ecosystems and digital governance in shaping corporate analytics capabilities (UNCTAD, 2021). The heatmap shows that countries investing in broadband, digital innovation centers, and skills development often improve their BI capabilities, supporting the TOE framework's assertion that environmental readiness is essential for technology adoption (Tornatzky & Fleischer, 1990).

Pattern analysis identifies three adoption groups: high performers (South Africa, Rwanda, Kenya), showing high scores across sectors; moderate performers (Namibia, Uganda, Senegal), with potential but specific weaknesses; and low performers (Cameroon, Zambia), facing structural barriers such as infrastructure deficits and limited digital skills. These findings support the notion that BI adoption is influenced by the interaction between national readiness and sector-specific factors, aligning with previous research on the multi-level determinants of BI integration (Elbashir et al., 2008). The heatmap clearly highlights disparities in BI use, emphasizing the need for targeted digital transformation strategies tailored to each country's specific context.

Figure 2 shows a sector-country heatmap of BI adoption levels across 10 African economies in the Technology, Finance, and Retail sectors. This map combines country- and sector-specific results into a single visual, providing a clearer view of digital maturity differences both among and within countries. In line with the TOE (Technology-Organization-Environment) theory, the graphic illustrates how institutional capacity, infrastructure, and sector factors influence BI adoption in various contexts (Tornatzky & Fleischer, 1990). The data used are actual BI scores from the study dataset, serving as a key analytical tool for comparing sectoral gaps, national capabilities, and digital transformation readiness.

Figure 2: Adoption of Sector-Level Business Intelligence in Ten Developing Economies in Africa.

This heatmap displays BI levels across the Technology, Finance, and Retail sectors in 10 African economies, based on actual data. Higher ratings (warmer colors) signify more advanced sectoral BI maturity and organizational readiness, while lower scores (cooler colors) indicate weaker digital capacity. Countries such as South Africa, Rwanda, Kenya, and Uganda have the highest cross-sector BI adoption, especially in Technology and Finance. Conversely, Cameroon, Ghana, and Zambia have noticeably lower ratings, particularly in the Retail Sector. The map illustrates the complex cross-national and sectoral differences that align with the TOE framework, highlighting the multifaceted nature of BI readiness in emerging markets.

Sector - Level B1 Adoption Across African Developing Economies Real Data

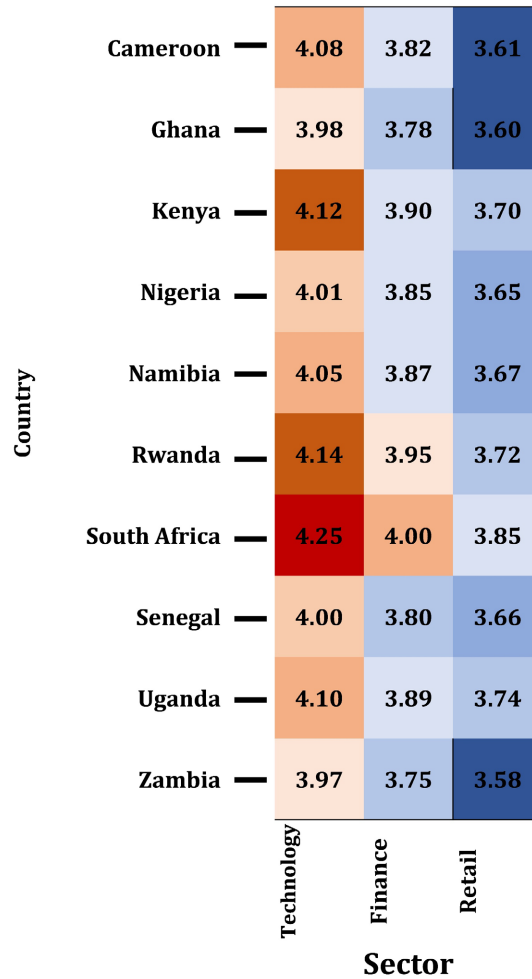


Figure 2. Sector-level business intelligence (BI) adoption scores across ten African developing economies (Real Data).

The heatmap shows a clear, consistent pattern: the Technology sector leads in BI adoption across all 10 countries, followed by Finance and then Retail. This hierarchy suggests that industries with strong digital infrastructure, high data reliance, and advanced ICT capabilities are more likely to adopt BI tools widely (Wamba et al., 2017). The Technology sector’s dominance is especially evident in South Africa (4.25), Rwanda (4.14), and Kenya (4.12), reflecting these nations’ commitments to digital innovation and skilled human resources. The visualization supports the idea that BI adoption is driven by sectors with high information-processing needs and robust technology infrastructure, confirming patterns observed in earlier studies of developing economies (Egala et al., 2024).

The heatmap also reveals significant variation among countries, with South Africa, Rwanda, Kenya, and Uganda consistently showing high BI usage across all sectors. These nations score above 4.00 in Technology and more than 3.85 in Finance, establishing them as regional leaders in digital technology. Conversely, countries like Ghana, Cameroon, and Zambia have more moderate adoption lev-

els, especially in Retail, with scores between 3.58 and 3.61. This difference illustrates how national ICT policies, digital infrastructure, and innovation ecosystems influence sectoral performance, aligning with research on digital readiness that emphasizes the importance of macro-level enablers in shaping organizational technology adoption (UNCTAD, 2021). The heatmap provides strong empirical evidence that BI adoption varies between countries and must be understood within each nation's digital development path.

The combined visualization offers crucial insights for both theory and practice. The grouping of high-performing nations across sectors highlights inherent national advantages, such as strong regulatory environments, increased ICT investments, and a digitally skilled workforce—factors aligned with the environmental and technological aspects of the TOE framework (Tornatzky & Fleischer, 1990). The consistently lower ratings in retail point to sector-specific challenges, such as limited digital literacy, fragmented data systems, or inadequate analytics training. These insights underscore the need for targeted digital transformation strategies that consider both national contexts and sector-specific dynamics. The heatmap not only confirms previous descriptive findings but also advances the discussion on differences in BI adoption among countries and sectors, paving the way for policy recommendations and regional digital development strategies.

12. Discussion

The heatmap shows that BI adoption in underdeveloped African nations varies across sectors and is not uniform, emphasizing the importance of industry-specific factors in shaping analytics integration. The Technology sector consistently has the highest adoption rates in all ten countries, with scores ranging from 3.97 to 4.25, reflecting its natural compatibility with digital transformation and advanced ICT capabilities. The Finance sector is closely followed due to regulatory demands and reliance on data-intensive processes (Wamba et al., 2017). Meanwhile, the Retail sector, with the lowest BI adoption scores (3.58 - 3.74), supports previous findings that industries with fragmented supply chains and low ICT investment often lag in analytics adoption (Egala et al., 2024). These patterns align with the Technology-Organization-Environment (TOE) framework, which suggests that technical readiness and industry environment significantly influence technology adoption (Tornatzky & Fleischer, 1990).

The heatmap illustrates cross-national differences that highlight the key impact of national digital ecosystems on BI adoption outcomes. South Africa, Rwanda, and Kenya lead in all industries, showing their ongoing investments in broadband infrastructure, digital literacy, and innovation ecosystems. Their Technology ratings surpass 4.10, and Finance scores are around or above 4.00, aligning with global assessments of their digital competitiveness (UNCTAD, 2021). Conversely, countries like Cameroon, Ghana, and Zambia have lower BI adoption scores, especially in Retail and Finance, due to core challenges including infrastructure gaps, diverse legal environments, and workforce capacity constraints. These cross-

national differences support the idea that BI adoption is heavily influenced by macro-level readiness and national policy environments, emphasizing the importance of the RBV and TOE frameworks in understanding how environmental factors shape digital capacity (Elbashir et al., 2008).

The heatmap further highlights the emergence of BI adoption clusters—high, medium, and low maturity—that reveal underlying structural patterns across the continent. Countries with high maturity have integrated, multisector business intelligence readiness, while medium-maturity countries show inconsistent yet improving abilities, and low-maturity countries face persistent structural challenges. These clusters demonstrate that BI adoption is a complex process influenced by technology infrastructure (Technology scores), organizational proficiency (Finance scores), and sector-specific constraints (Retail scores).

This alignment provides strong empirical support for the TOE model's multidimensional framework and the RBV's assertion that businesses and nations need to acquire or develop complementary resources to maximize BI utilization (Tornatzky & Fleischer, 1990; Elbashir et al., 2008). The heatmap enhances understanding of the progress of BI adoption across countries and sectors, thereby strengthening the theoretical basis for digital transformation research in African contexts. These clusters indicate that BI adoption operates as a multilevel phenomenon influenced by technological infrastructure (Technology scores), organizational capability (Finance scores), and sector-specific constraints (Retail scores), rather than being governed by a singular, uniform driver across contexts.

13. Recommendations for Policy and Practice

Governments should prioritize strengthening national ICT infrastructure and digital governance frameworks to support the adoption of BI across all sectors. Countries with strong performance in the heatmap show that ongoing investment in internet services, data centers, and digital skills programs leads to higher BI scores in Technology and Finance. Countries with lower adoption scores, including Cameroon, Ghana, and Zambia, should implement targeted national digital transformation initiatives to improve connectivity, enhance cybersecurity, and incentivize the deployment of BI systems (UNCTAD, 2021).

Countries with lower adoption scores, including Cameroon, Ghana, and Zambia, should implement targeted national digital transformation initiatives that combine infrastructure investments with specific incentives for business intelligence (BI) adoption. These incentives could include short-term tax credits for analytics software and cloud services, public co-funding for initial BI implementations in small and medium-sized enterprises (SMEs), and performance-based grants for companies demonstrating measurable improvements in data-driven decision-making (UNCTAD, 2021). These policy measures not only lower the initial cost of BI systems but also show a long-term government commitment to building resilient, data-driven economies.

Sector-specific tactics are crucial for bridging adoption gaps, especially in retail,

which consistently has the lowest scores across all 10 nations. Governments and industry associations can offer co-funded digitalization vouchers to help finance the purchase of advanced POS, inventory, and customer analytics systems in retail; create sector-specific data analytics academies to train retail managers and staff in business intelligence interpretation; and encourage public-private partnerships that include retailers in mobile-money and fintech ecosystems. These practical tools support the transformation of low-maturity retail environments into data-driven, analytics-capable sectors, rather than limiting business intelligence adoption to sporadic, organization-wide efforts.

The Finance and Technology sectors, already strong, should be supported by regulatory sandboxes, open banking frameworks, and national innovation hubs that encourage experimentation with advanced analytics, AI-powered risk models, and real-time dashboards. These approaches improve BI maturity in high-performing sectors while creating spillover effects—through shared platforms, interoperable systems, and cross-sector digital skills—that can eventually help underperforming businesses.

Policymakers and private-sector leaders must advocate for sector-specific workforce training in data analytics, allocate resources to modern POS and inventory systems, and establish collaborations with fintech and technology providers to accelerate digital adoption. The finance and technology sectors, already strong, should be further strengthened through regulatory sandboxes, open banking frameworks, and innovation hubs to improve BI maturity.

At the organizational level, organizations in high-maturity countries like South Africa, Rwanda, and Kenya should focus on expanding advanced analytics—such as predictive modeling, machine learning, and real-time dashboards—by investing in leadership development, establishing formal data governance councils, and creating cross-functional analytics teams. Organizations in medium-maturity environments such as Namibia, Uganda, and Senegal should institutionalize BI use through standardized reporting protocols, change management initiatives that integrate BI into performance evaluations, and targeted upskilling of middle management. In low-maturity contexts like Cameroon and Zambia, development partners and regional organizations such as the AU and AfDB can play a catalytic role by funding regional BI centers of excellence, offering shared training platforms, and supporting pilot BI projects in strategically important sectors. By tailoring interventions to BI maturity levels rather than adopting a one-size-fits-all approach, policymakers and practitioners can leverage the patterns identified in our study to develop more equitable and effective digital transformation strategies.

14. Significance of the Research and Its Contribution

This paper examines the adoption of Business Intelligence (BI) in 10 developing African economies, emphasizing the structural, technological, and institutional factors that either enable or hinder digital transformation across the continent. It

goes beyond individual organizations to investigate cross-national trends, sectoral differences, and levels of preparedness that impact the spread of BI. The study focuses on country-level differences rather than profitability or firm-specific effects, highlighting how national ecosystems—such as ICT infrastructure, regulatory policies, workforce digital skills, and innovation systems—shape the path of BI adoption. This provides a unique empirical foundation that is rarely addressed in African digital transformation research.

This manuscript warrants reader engagement as it provides a comprehensive comparative analysis of BI adoption across various African countries, filling a significant gap in both global and regional research. Although digital transformation is widely discussed, there is a lack of research explaining the primary reasons for the significant differences in adoption rates among nations or identifying the national factors that accelerate technological progress. The article offers evidence-based insights for policymakers, investors, scholars, and digital practitioners to understand continental differences and identify high-potential markets and innovation barriers. Its comparative perspective makes it relevant for anyone involved in technology ecosystems, development policy, or digital competitiveness.

This report serves various audiences by providing a comprehensive overview of Africa's business intelligence adoption landscape. It lays a theoretical and empirical foundation for future research on cross-national digital readiness. It outlines the maturity of BI capabilities for industry leaders and technology organizations, highlighting unexplored opportunities to inform market entry and strategic investments. It offers prioritized strategies for enhancing digital capacity for development agencies and regional organizations. The article functions as a practical tool that helps stakeholders identify digital gaps, understand the reasons behind their persistence, and find effective mechanisms to address them.

The study's conclusions provide a framework for developing countries to design targeted digital transformation projects aligned with their national strengths and developmental needs. The report highlights nations that lack BI adoption. It examines the reasons, helping governments prioritize investments in ICT infrastructure, enhance digital governance, allocate resources more efficiently, and develop human capital for analytics-driven growth. This work is justified by its contribution to equitable digital development, offering African economies empirical evidence essential for accelerating BI-enabled decision-making, improving service delivery across all sectors, increasing private-sector competitiveness, and supporting long-term socio-economic transformation. The report lays the necessary foundation for Africa to bridge digital gaps and fully participate in the global knowledge economy.

15. Limitations

A key weakness of this study is its reliance on descriptive and comparative analyses, which provide valuable cross-national insights but do not establish causal links between country characteristics and BI adoption outcomes. The data identify

patterns among the ten growing African countries; however, the absence of regression or structural modeling limits the study's ability to assess the strength or direction of these relationships. Therefore, conclusions should be viewed as correlational rather than predictive, in line with the acknowledged methodological limitations of technology adoption studies (Wamba et al., 2017).

Another limitation arises from the uneven quality and distribution of data across countries and sectors. Some countries had strong representation from financial and technology respondents, while others had more limited participation from sectors like retail services. This imbalance could introduce biases in cross-national comparisons and might not accurately reflect industries in countries with weaker digital reporting systems. Therefore, the results should be seen as indicative rather than fully representative of each country's BI maturity levels.

The study also lacks a longitudinal component, which limits the ability to analyze BI adoption trends over time. The rapid pace of digital transformation in Africa renders a single cross-sectional dataset insufficient for capturing the ongoing changes in national digital policies, infrastructure investments, and organizational readiness. Without time-series data, the research cannot determine whether adoption patterns will accelerate, stall, or diverge in response to external shocks, regulatory changes, or technological advancements. This limits the study's predictive and temporal explanation capabilities.

Future Research Directions

Future studies should expand on the descriptive methodology used here by incorporating causal and predictive modeling tools to deepen understanding further. Techniques such as Structural Equation Modeling (SEM), multi-level regression, or machine learning forecasting can effectively assess how technical readiness, policy environments, and organizational capabilities influence business intelligence adoption outcomes. These advanced statistical methods will enhance our understanding of the factors underlying national differences and provide empirical support for policy and investment decisions across the continent.

Future research should broaden its sectoral and geographic scope to include more African economies and underrepresented industries. Incorporating sectors such as agriculture, healthcare, logistics, manufacturing, and education may reveal new adoption trends and sector-specific challenges that this analysis did not explore. Including other countries—both developing and middle-income—would allow researchers to determine whether the trends found in this study are consistent across different levels of economic development and digital maturity.

Future research should focus on integrating longitudinal data and mixed-methods approaches to enhance understanding. Longitudinal datasets can track the adoption of BI over time, enabling researchers to identify acceleration points, policy impacts, and patterns of technological diffusion within African countries. Mixed-methods research, including interviews, case studies, or anthropological insights, could deepen understanding of the cultural, managerial, and behavioral

factors influencing adoption decisions. This combined approach would offer a more comprehensive and detailed understanding of BI maturity across the continent.

16. Conclusion

This study concludes that the patterns of business intelligence adoption across ten African developing economies are linked to differences in national digital maturity and sector-specific technology readiness, as demonstrated by the descriptive evidence presented.

This study also concludes that the adoption of BI in the ten African developing nations examined is influenced by each country's level of digital maturity and sector-specific technological readiness. The heatmap results show that the Technology sector leads in BI integration across all nations, closely followed by the Finance sector, while the Retail sector consistently underperforms. These patterns highlight the uneven distribution of analytics capabilities and reveal systemic factors that impact digital transformation outcomes across different sectors and national contexts.

The depiction of sector-specific BI ratings reveals apparent cross-national differences, with South Africa, Rwanda, and Kenya leading, while Cameroon, Ghana, and Zambia show somewhat lower adoption rates. These findings contribute to the academic literature by providing empirical, sector-specific evidence of BI maturity within African economies, a field that remains underexplored in current digital transformation research (UNCTAD, 2021). The results support theoretical claims that technology adoption depends on environmental readiness, organizational competency, and technological infrastructure—key factors emphasized in the TOE paradigm.

The study's findings underscore the importance of comprehensive digital transformation efforts that address both national infrastructure needs and sector-specific gaps. The research identifies distinct BI maturity groups across various countries and industries, offering practical insights for policymakers, organizations, and development stakeholders seeking to improve analytical skills. The study deepens understanding of BI adoption in developing African economies. It provides an empirical basis for creating strategic actions that foster data-driven decision-making, competitiveness, and sustainable technological progress.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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Appendix

The appendix provides definitions and supporting explanations for key concepts and terms used throughout the manuscript.

KEYWORDS

Business Intelligence (BI)

Business Intelligence refers to the technologies, tools, and processes used to gather, analyze, and present organizational data for strategic decision-making. In developing African economies, BI helps companies turn raw data into actionable insights, enhancing operational efficiency, competitiveness, and resource management. Its adoption reflects broader national digital transformation efforts.

Digital Readiness

Digital readiness measures how well a country's technological infrastructure, ICT capabilities, and workforce skills support digital innovation. High digital readiness speeds up BI adoption by ensuring reliable networks, data systems, and human resources. Differences in digital readiness across Africa greatly influence national adoption outcomes.

Technology-Organization-Environment (TOE) Framework

The TOE framework explains technology adoption through three interconnected dimensions: technological capability, organizational readiness, and environmental pressures. It provides a comprehensive perspective to analyze how national and sector-level factors impact BI adoption. In this study, TOE functions as the primary theoretical foundation for cross-national comparisons.

Cross-National Comparative Analysis

Cross-national analysis involves studying differences and similarities in BI adoption across countries. This approach highlights how national infrastructure, institutional conditions, and sectoral dynamics influence different adoption paths. It offers evidence-based insights for policymakers, investors, and digital strategists.

Sector-Level Dynamics

Sector-level dynamics refer to industry-specific conditions—such as compliance requirements, digital maturity, and market competition—that influence technology adoption. In African economies, finance and technology sectors often lead BI implementation, while the retail sector advances more gradually. These dynamics help explain variability in adoption within countries.

ICT Infrastructure

ICT infrastructure includes the essential digital systems—such as broadband networks, data centers, hardware, and software—that support BI tools. Countries with stronger ICT infrastructure tend to have higher BI adoption due to better reliability, connectivity, and integration. In many developing economies, weak infrastructure remains a significant barrier.

Digital Transformation in Africa

Digital transformation describes the continent-wide shift toward technology-driven growth, innovation, and service delivery. BI adoption is a crucial part of this process, enabling data-driven governance, improved organizational perfor-

mance, and a competitive edge. Recognizing its cross-national differences is crucial for creating effective digital policies.

RQ1: Sectoral BI Adoption Differences

Examines how BI adoption varies across the Technology, Finance, and Retail sectors.

Identifies which sectors lead or lag in analytics integration.

Highlights industry-specific readiness and capability gaps.

RQ2: Cross-National BI Adoption Patterns

Compares BI adoption levels across ten African developing economies.

Reveals national strengths, weaknesses, and digital maturity gaps.

Explains how country-level digital ecosystems influence BI capability.

RQ3: TOE Determinants of BI Adoption

Examines how technological readiness, organizational capability, and environmental factors influence BI adoption. Connects BI maturity to broader structural and contextual conditions. Demonstrates BI as a multidimensional capability shaped by the TOE framework.

RQ4: BI Maturity Clusters and Digital Strategy

Identifies BI maturity groups across countries and sectors. Highlights shared traits among high, medium, and low adopters. Guides strategic actions to advance digital transformation.

Comprehensive Descriptions

This study suggests that the adoption of Business Intelligence (BI) in African economies varies significantly due to differences in digital infrastructure, institutional readiness, and strategic investment objectives. Previous research shows that BI adoption is influenced by both organizational capabilities and national factors, such as ICT policy, regulatory stability, and workforce digital skills (Wamba et al., 2017; Elbashir et al., 2008). This study argues that national ecosystems, rather than just firm-level attributes, affect the speed and quality of business innovation diffusion, using a comparison of 10 developing African economies. This cross-national perspective provides a deeper understanding of why some African economies experience rapid digital transformation, while others progress more slowly.

Data from ten nations show significant differences in BI usage, sectoral demand, and management adoption. Countries with strong ICT infrastructure and high technology investment—such as Kenya, Rwanda, and South Africa—demonstrate greater BI adoption compared to emerging digital markets with weaker infrastructure (Egala et al., 2024). A sector comparison reveals that the financial and technology sectors primarily excel in business intelligence adoption, while the retail sector lags due to resource constraints or policy issues. These differences indicate that a country's readiness is a key factor that either encourages or delays digital decision-support innovation.

Examining these differences through a comparative lens shows that BI adoption in Africa varies and is closely connected to broader socio-economic, institutional, and policy factors. The Technology-Organization-Environment (TOE) model ex-

plains how national environmental elements—such as government support, ICT laws, and market forces—interact with organizational readiness to influence adoption choices (Tornatzky & Fleischer, 1990). The Resource-Based View (RBV) principles state that internal capabilities alone cannot achieve Business Intelligence (BI) maturity without alignment with external factors. This analysis suggests that African economies with robust digital ecosystems are more successful at leveraging BI tools to create strategic value than those lacking supportive national infrastructure.

These findings have significant implications for Africa's digital transformation strategy, underscoring the need for country-specific approaches rather than uniform continental initiatives. Policymakers and development organizations can use the cross-national insights from this study to tailor capacity-building efforts, strengthen digital governance frameworks, and foster private partnerships aligned with national priorities. Additionally, international corporations and investors can utilize these insights to identify markets with higher BI readiness and develop sector-specific entry strategies. Ultimately, understanding the differences in cross-national BI adoption fills a significant empirical gap in African digital research and supports the African Union's goal to coordinate digital progress across the continent (African Union, AU, 2020), positioning BI as a driver of sustainable economic competitiveness.