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## RESEARCH ARTICLE

### DESIGN AND DEPLOYMENT OF A DECISION SUPPORT SYSTEM FOR DIGITAL MATURITY ASSESSMENT OF BENINESE MUNICIPALITIES

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#### ABSTRACT

The digital transformation of local governments in developing countries presents major challenges for governance efficiency and inclusiveness. This study introduces the design and implementation of an innovative Decision Support System (DSS) for assessing and monitoring the digital maturity of 77 municipalities in Benin, across 12 administrative departments. The main objective is to develop a structured and interactive dashboard that allows decision-makers to identify digital strengths and weaknesses in their territories. The DSS is built upon a six-year longitudinal dataset (2016–2021) using 45 standardized indicators distributed across six governance domains: political and administrative governance, financial governance, participatory governance and gender, territorial and land management, supervisory relations, and cross-cutting indicators. The system processed 462 municipality-year observations, enabling multi-dimensional analytics including K-Means clustering and linear regression modeling. Results show significant disparities in digital readiness: 23% of municipalities are classified as “Advanced,” 34% as “Developing,” and 43% as “Basic.” The platform achieved 95% data consistency and 99.2% uptime, with 78% of users reporting enhanced understanding of their municipality’s digital maturity. Overall, the DSS offers a synthetic and objective perspective of municipal digital performance, significantly improving diagnostic efficiency and serving as a foundation for predictive modeling and evidence-based decision-making.

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## INTRODUCTION

The digital transformation of territories has become a critical challenge for local governance in the 21st century, particularly in developing countries where digital infrastructure gaps and resource constraints create unique challenges. In Benin, with its 77 municipalities spread across 12 departments, the need for systematic digital maturity assessment has become increasingly apparent as the country strives to modernize its public administration and improve service delivery to citizens. The concept of digital maturity in municipal governance encompasses various dimensions including technological infrastructure, digital service provision, administrative digitization, citizen engagement through digital channels, and institutional capacity for digital innovation. Traditional assessment methods often rely on fragmented data collection processes that are time-consuming, costly, and may not provide the comprehensive view needed for strategic decision-making. This research addresses the critical gap in systematic digital maturity assessment tools specifically designed for the Beninese municipal context. The development of a Decision Support System (DSS) represents a paradigm shift from ad-hoc assessments to continuous, data-driven monitoring of digital transformation progress at the municipal level.

## LITERATURE REVIEW

**Digital Governance in Developing Countries:** Digital governance frameworks have evolved considerably over the past decade, with various models proposed for different contexts. The United Nations

E-Government Development Index (EGDI) provides a global framework, but lacks the granular municipal-level focus needed for local governance applications. Similarly, the European Commission’s Digital Economy and Society Index (DESI) offers comprehensive metrics but requires adaptation for African contexts.

**Decision Support Systems for Municipal Management:** DSS applications in municipal management have shown promising results in various contexts. Previous studies have demonstrated the effectiveness of interactive dashboards in improving decision-making processes, particularly when dealing with complex, multi-dimensional challenges such as urban planning, resource allocation, and service delivery optimization.

**Digital Maturity Assessment Models:** Existing digital maturity models, such as the Digital Maturity Model (DMM) and the Government Digital Maturity Model, provide theoretical frameworks but often lack practical implementation guidelines for specific regional contexts. The adaptation of these models to the Beninese municipal context requires consideration of local infrastructure limitations, capacity constraints, and governance structures.

## MATERIALS AND METHODS

### System Architecture

The Decision Support System (DSS) was developed using a modular and extensible architecture designed to meet the heterogeneous needs of Beninese municipalities while ensuring long-term scalability,

interoperability, and maintainability. The overall architecture is composed of four interdependent modules that collectively support the end-to-end data lifecycle—ranging from acquisition and validation to analysis, visualization, and dissemination.

### 1. Data Collection Module

This module ensures both automated and semi-automated ingestion of data from multiple heterogeneous sources. Inputs include municipal administrative records, national statistical repositories, departmental oversight reports, and structured survey instruments. The collection workflows integrate scheduled data harvesting routines, manual upload capabilities, and metadata tagging procedures to preserve data provenance and traceability.

### 2. Data Processing Engine

The processing engine constitutes the analytical core of the DSS. It embeds advanced routines for data cleansing, validation, and transformation, including:

- Missing-value imputation,
- Outlier detection,
- Cross-source consistency checks, and
- Temporal alignment of multi-year datasets.

The engine standardizes all indicators according to predefined ontologies and nomenclature systems, ensuring comparability across municipalities and across the six assessment domains. All transformations conform to the system's data governance protocol and are automatically logged for auditability.

### 3. Analysis and Visualization Module

This module provides interactive analytical capabilities through a web-based interface optimized for variable device types and connectivity conditions. It incorporates:

- Descriptive analytics (municipality-year statistics, trend visualization),
- Comparative analytics (departmental and national Benchmarking), and
- Advanced analytics (K-Means clustering, linear regression modeling).

The dashboard architecture supports dynamic filtering, multi-level drill-down navigation, and historical trajectory visualization, enabling decision-makers to explore governance and digital maturity patterns in real time.

### 4. Reporting and Export System

The reporting module generates standardized outputs tailored to the information needs of distinct stakeholder groups, including municipal executives, departmental administrations, and national policy authorities. It supports multiple export formats (PDF, CSV, XLSX) and incorporates automated report generation templates summarizing key performance indicators, compliance metrics, and digital maturity scores. The system also integrates role-based access control to ensure secure dissemination of sensitive governance data.

**The system integrates data from multiple sources covering the period 2016-2021:**

- **Municipal Administrative Records:** Comprehensive governance indicators across all six domains including council sessions,

budget execution, service functionality, and administrative procedures.

- **National Statistical Databases:** Demographic, economic, and infrastructure data from INSAE (Institut National de la Statistique et de l'Analyse Économique).
- **Departmental Administrative Records:** Data on municipal compliance, budget transmission, and inter-institutional coordination.
- **Survey Data:** Primary data collection through structured questionnaires administered to municipal officials and citizens covering all 45 governance indicators.

### *Municipal Governance Assessment Framework*

The assessment framework encompasses six comprehensive governance domains with 45 standardized indicators, providing a holistic view of municipal governance maturity:

#### **Domain 1: Political and Administrative Governance (15 indicators):**

- Number of ordinary sessions of the municipal council
- Rate of functional services
- Rate of participation of elected officials in municipal councils
- Existence of an up-to-date procedures manual
- Staff evaluation rate
- Functional standing commission rates
- Adequacy rate Profile/Position
- Functionality of the filing and archiving system
- Local public service rate in delegated management
- Number of Mayor's activity reports
- Number of municipal meetings (communal council office)
- Average number of district council sessions
- Average number of village council sessions
- Number of signature delegation from the mayor to the deputies
- Number of delegation of power carried out by the mayor
- Domain 2: Financial Governance (11 indicators):
- Rate of implementation of the municipal budget
- Self-financing rate of investments
- Share of investments in the total expenses of the Commune
- Rate of maintenance expenses
- Adoption of the budget on time
- Compliance with the voting deadline for the Administrative Account
- Rate of increase in own resources
- Tax recovery rate of the municipality
- Average lead time for awarding municipal public contracts
- Existence of validated and published Procurement Plans
- Ratio of public contracts that have followed the procedures
- Domain 3: Participatory Governance and Gender (4 indicators):
- Display of the Communal Council's decision statements within the deadlines
- Number of accountability sessions
- Number of specific actions in favour of women during the year
- Existence of a mechanism for informing the public about the municipality's services
- Domain 4: Territorial and Land Governance (9 indicators):
- Existence of a Master Development Plan for the Commune (SDAC)
- Existence of a Municipal Development Plan (PDC)
- Number of PTA/IAP/PAD M&E meetings
- Rate of increase in economic and market infrastructure
- Functionality of land management bodies at communal and infra-communal levels
- Existence of an updated Social Dashboard
- Number of decentralised cooperation agreements implemented
- Rate of payment of the commune's contributions to the intercommunality
- Number of land disputes involving the municipality

- Domain 5: Relations with guardianship (5 indicators):
- Number of participants in meetings of the Departmental Council for Consultation and Coordination (CDCC)
- Compliance rate of communal acts
- Timely transmission of the budget
- Transmission of the administrative account within the deadlines
- Animation of a consultation framework between the Mayor and the decentralized communal services
- Domain 6: Transversal Indicators (1 indicator):
- Number of functional consultation frameworks (Education; Water, Hygiene and Sanitation; Agricultural; Mayor and CSO)

### Framework Evolution and New Digital Indicators

The original governance assessment framework contained 39 traditional indicators across five domains. Based on the evolving digital governance landscape and stakeholder feedback, 6 new indicators have been strategically added to enhance the framework's comprehensiveness:

### Newly Added Digital Governance Indicators

- Digital tools for board sessions (%) - Measures frequency of digital tool utilization for official meetings, reflecting the modernization of administrative processes
- Digital tax recovery (%) - Assesses electronic payment integration for municipal revenue collection, improving efficiency and transparency
- e-Procurement (%) - Evaluates digital management of public procurement processes, enhancing transparency and reducing administrative burden
- Digitization of the budget (%) - Tracks the proportion of budget allocated to digital projects, indicating strategic commitment to digital transformation
- Digital inclusion of women (%) - Measures women's participation in digital tools and services, ensuring gender-inclusive digital development
- Participatory platforms (%) - Assesses citizen engagement through digital platforms, promoting democratic participation
- Modified Traditional Indicators:
- Match Rate Profile/Position - Enhanced to include digital competency correspondence in staff-position matching
- Filing and archiving system functionality - Extended to include digital archiving and dematerialization capabilities
- Existence of a public information mechanism - Augmented with digital portals and mobile applications for public information dissemination

### Cross-cutting Digital Indicators

- GIS tools - Availability and use of geographic information systems for territorial management
- Dematerialization of land (%) - Digitization of land data and records
- Accessibility of digital infrastructure (%) - Ease of access to digital equipment and services
- Internet access (%) - Internet coverage rate at the municipal level
- Digital training (%) - Rate of municipal staff trained in digital tools
- Citizen satisfaction (Score 1-5) - Citizens' satisfaction with digital services
- SME adoption (%) - Proportion of local SMEs integrating digital tools

### Data Analysis Methodology

The system employs both descriptive and comparative analytics:

- Temporal Analysis: Trend identification and trajectory modeling using time-series data from 2016-2021.
- Comparative Analysis: Benchmarking capabilities allowing municipalities to compare their performance against peers, departmental averages, and national standards.
- Gap Analysis: Identification of specific areas requiring intervention through automated gap detection algorithms.

## RESULTS

### System Implementation

The DSS was successfully deployed across all 77 Beninese municipalities with the following technical specifications:

- Database System: Centralized data warehouse with distributed access points
- User Interface: Web-based responsive design supporting various devices and connection speeds
- Security Framework: Multi-level authentication and data protection protocols
- Performance Metrics: Average response time under 3 seconds for standard queries

### Digital Maturity Assessment Outcomes

Preliminary analysis of the 2016-2021 data reveals significant variations in digital maturity across municipalities:

#### Infrastructure Maturity:

- 23% of municipalities rated as "Advanced" (scores 80-100)
- 34% rated as "Developing" (scores 60-79)
- 43% rated as "Basic" (scores below 60)

#### Service Digitization:

- Only 15% of municipalities offer comprehensive online services
- 45% provide limited digital services
- 40% rely primarily on traditional service delivery methods

#### Administrative Digitization:

- 28% have implemented comprehensive digital management systems
- 52% use partial digitization approaches
- 20% maintain largely paper-based processes

### User Adoption and Feedback

Initial deployment results indicate positive reception among municipal officials:

- 78% of users report improved understanding of their municipality's digital status
- 65% indicate the system saves significant time compared to traditional assessment methods
- 82% express satisfaction with the dashboard's usability and functionality

### System Performance Metrics

The DSS demonstrates strong technical performance:

- Data Accuracy: 95% consistency rate across validated data points
- System Availability: 99.2% uptime during the initial deployment period

- User Engagement: Average session duration of 45 minutes with 73% task completion rate

## DISCUSSION

**Innovation and Contribution:** The DSS represents a significant advancement in digital governance assessment tools for developing countries. The Decision Support System (DSS) developed in this study introduces a major conceptual and methodological innovation in the field of digital governance assessment for developing countries. By integrating data analytics, visualization, and predictive modeling, the DSS transcends traditional diagnostic tools that often rely on static or qualitative assessments. Its modular and scalable architecture enables adaptation to diverse local contexts while maintaining methodological coherence across municipalities. Theoretically, the system contributes to the emerging literature on smart governance and digital maturity models, by operationalizing a quantitative and data-driven framework applicable to decentralized administrations. It provides an analytical foundation for linking digital readiness with governance performance, thereby bridging a long-standing gap between technological and institutional dimensions of public sector modernization.

**Strategic and Practical Implications:** From a strategic perspective, the DSS redefines how municipalities approach digital transformation by promoting data-informed decision-making and continuous learning cycles within local administrations.

### The main implications are multidimensional

- Institutional Empowerment – The platform decentralizes access to digital intelligence, allowing local governments to take ownership of their digital agendas instead of relying solely on national agencies or donors.
- Evidence-Based Planning – Decision-makers can now design policies grounded in objective performance indicators rather than subjective perceptions. This strengthens accountability and transparency in resource allocation.
- Capacity Development – The DSS acts as both an analytical tool and a learning mechanism, fostering digital literacy and analytical competence among municipal officials.
- Policy Coherence – By aligning local data with national strategies (e.g., Benin's *Stratégie Nationale de Développement du Numérique*), the system ensures vertical integration between local and national digital governance frameworks.
- Regional Benchmarking – The system's comparative dashboards facilitate horizontal learning across municipalities and can serve as a model for regional cooperation in West Africa.

### Governance Implications

Beyond technical efficiency, the DSS has direct implications for governance quality and democratic accountability. By enabling real-time transparency and citizen-oriented performance tracking, it enhances trust in local institutions. The availability of reliable, comparable indicators empowers civil society and oversight bodies to engage constructively in governance evaluation. Furthermore, by identifying areas of low digital maturity, the DSS helps prioritize interventions in municipalities most in need, contributing to equity in digital inclusion across territories.

**Implementation Challenges and Institutional Constraints:** The development and deployment of the DSS encountered several structural and institutional challenges. First, data quality and interoperability remain critical issues: varying data collection practices and incomplete archives demanded substantial standardization efforts. Second, limited human capacity in data analytics and digital management within some municipalities restricted early adoption. Third, unequal connectivity—particularly in

rural communes—created barriers to real-time access. Finally, change resistance among administrative staff required sustained communication and capacity-building programs to ensure system appropriation. These constraints highlight that successful digital transformation is not only a technological challenge but also a governance and leadership process requiring political commitment, cultural adaptation, and institutional support mechanisms.

### Future Development and Research Perspectives

Looking ahead, the DSS offers fertile ground for technological and policy evolution. Planned developments include:

- Integration of AI-based predictive analytics to forecast digital maturity trends and governance trajectories;
- Deployment of a mobile application to enable offline data entry and real-time synchronization from field locations;
- Implementation of machine learning recommendation systems to guide municipalities in prioritizing digital investments;
- Expansion to regional digital governance networks for knowledge sharing and comparative benchmarking;
- Development of dynamic dashboards integrating live data feeds (IoT and network infrastructure monitoring).

Academically, this platform sets the stage for future empirical studies exploring causal relationships between digital maturity, governance efficiency, and citizen satisfaction. It also invites interdisciplinary collaboration between computer scientists, public policy experts, and social scientists, aiming to refine hybrid models of smart local governance.

### Detailed Comparative Analysis of Indicators

#### Comprehensive Indicator Evolution Table

The following table presents a systematic comparison between traditional and enhanced digital governance indicators:

#### Validation Methodology Framework

##### Multi-Phase Validation Process

The validation of enhanced digital governance indicators followed a rigorous four-phase methodology:

##### Phase 1: Technical Feasibility Assessment (Duration: 3 months)

- Data availability analysis across 77 municipalities
- Cost-benefit evaluation for new data collection processes
- Technical infrastructure requirements assessment
- Reliability and consistency validation using historical data

##### Phase 2: Scientific Validation (Duration: 4 months)

- Expert panel review with governance specialists
- Statistical correlation analysis with development outcomes
- Academic peer review process
- Validation against international digital governance standards

##### Phase 3: Pilot Implementation (Duration: 6 months)

- Test deployment in representative municipalities across multiple departments
- Real-world applicability testing
- Threshold and benchmark calibration
- Feedback-based refinement of indicators

##### Phase 4: Stakeholder Consultation (Duration: 3 months)

- Municipal official workshops
- Civil society organization consultations
- Citizen feedback sessions
- National government validation process

### Indicator Selection Criteria

The enhanced indicators were selected based on five critical criteria:

- Relevance (Weight: 25%): Alignment with Benin's National Digital Strategy 2018-2025
- Measurability (Weight: 20%): Objective data collection feasibility
- Comparability (Weight: 20%): Inter-municipal benchmarking capability

- Actionability (Weight: 20%): Direct linkage to improvement actions
- Acceptability (Weight: 15%): Stakeholder consensus and adoption potential

**Stakeholder Engagement Statistics**

**The validation process involved comprehensive stakeholder participation:**

- Municipal Leaders: Local mayors and municipal secretaries consulted
- Technical Staff: Municipal technicians trained and surveyed
- Civil Society: Local organizations and community groups engaged
- Citizens: Respondents across rural and urban contexts
- Academic Community: Researchers from regional universities
- Development Partners: International cooperation organizations

**Concrete Application: Ouinhi Municipality Case Study**

**Municipality Profile and Context**

Ouinhi Municipality, located in Zou Department, serves as an exemplary case for the DSS application. With a population of 59,856 inhabitants spread across 483 km<sup>2</sup>, Ouinhi represents typical challenges faced by rural Beninese municipalities: limited digital infrastructure, resource constraints, and dispersed administrative services.

**Key Municipal Characteristics:**

- Geographic Coverage: 13 villages and 52 districts
- Economic Base: Agriculture (78%), trade (15%), services (7%)

**Specific Achievement:** Implementation of hybrid council sessions during COVID-19, maintaining democratic processes while ensuring safety.

**Financial Governance (Score: 72/100)**

- **Digital tax collection:** 35% of revenue through mobile payments
- **e-Procurement:** 60% of public contracts processed digitally
- **Budget digitalization:** 15% allocated to digital transformation projects

**Impact Measurement:** Tax collection efficiency improved by 43%, reducing administrative costs by 180,000 FCFA annually.

**Participative and Gender Governance (Score: 45/100)**

- **Digital information platforms:** Municipal website with 2,400 monthly visitors
- **Women’s digital inclusion:** 22% participation in digital services
- **Citizen feedback mechanisms:** WhatsApp group with 340 active members

**Citizen Engagement Results:** 67% increase in citizen participation in municipal consultations through digital channels.

**Concrete Project Examples**

Project Sheet 1 – Digital Revenue Collection and e-Procurement System

Domain	Traditional Indicator	Enhanced Digital Indicator	Measure Type	Status	Justification
Political-Administrative	Number of regular sessions of the Council	Sessions with digital tools (%)	%	Modified	Integration of digital meeting technologies
Political-Administrative	Rate of functional services	Digital service functionality rate (%)	%	Enhanced	Quality assessment including digital capabilities
Political-Administrative	Filing and archiving system	Digital archiving system functionality	Binary	Modified	Dematerialization and digital document management
Financial	Tax recovery rate	Digital tax collection rate (%)	%	Added	Electronic payment integration
Financial	Average lead time for procurement	e-Procurement implementation (%)	%	Added	Digital procurement process management
Financial	Budget adoption process	Budget digitalization (%)	%	Added	Digital budget allocation for transformation
Participative-Gender	Public information mechanism	Digital information platforms (%)	%	Modified	Web portals and mobile applications
Participative-Gender	Specific actions for women	Digital inclusion of women (%)	%	Enhanced	Gender-inclusive digital participation
Territorial-Land	Existence of a SDAC	GIS tools availability	Binary	Added	Geographic Information Systems implementation
Territorial-Land	Land management	Land digitalization (%)	%	Added	Digital land records and management
Cross-cutting	-	Digital infrastructure accessibility (%)	%	Added	Access to digital equipment and services
Cross-cutting	-	Internet access rate (%)	%	Added	Municipal-level connectivity coverage
Cross-cutting	-	Digital training rate (%)	%	Added	Staff digital competency development
Cross-cutting	-	Citizen satisfaction with digital services	Score 1-5	Added	User experience assessment
Cross-cutting	-	SME digital adoption (%)	%	Added	Local business digital integration

- Digital Infrastructure: 23% internet coverage, 45% mobile network coverage
- Administrative Capacity: 47 municipal staff, 15% with digital training

**DSS Implementation Results in Ouinhi**

**Digital Governance Score Evolution (2019-2021)**

**Overall Digital Maturity Progression:**

- 2019 Baseline: 34/100 (Basic level)
- 2020 Intermediate: 52/100 (Developing level)
- 2021 Current: 67/100 (Developing-Advanced transition)

**Domain-Specific Analysis:**

**Political-Administrative Governance (Score: 58/100)**

- Digital meeting tools adoption: 40% (improved from 5% in 2019)
- Digital archiving system: Partially implemented (score 6/10)
- Staff digital competency: 28% trained (target: 60% by 2024)

Category	Details
<b>Project Title</b>	Digital Revenue Collection and e-Procurement System
<b>Objectives</b>	- Improve efficiency in municipal revenue mobilization - Increase transparency and accountability in procurement processes
<b>Key Activities</b>	- Implement mobile payment system for tax collection - Deploy digital e-procurement platform - Staff training on financial digital tools - Awareness campaigns for citizens and SMEs
<b>Measurable Results</b>	- 35% of revenues collected digitally - 60% of contracts processed via e-procurement - <b>43%</b> increase in tax collection efficiency - Annual administrative cost savings of <b>180,000 FCFA</b> - <b>125%</b> increase in revenues from land certificate services
<b>Impact</b>	- Strengthened financial governance - Improved transparency and reduced corruption risks - Increased citizen trust in municipal financial management
<b>Future Perspectives</b>	- Extend mobile payment to all municipal revenue streams - Integrate blockchain for secure auditing - Strengthen partnerships with telecom operators to expand digital coverage

**Project Sheet 2 – Digital Participation and Citizen Engagement Platform**

Category	Details
<b>Project Title</b>	Digital Participation and Citizen Engagement Platform
<b>Objectives</b>	- Enhance citizen participation in municipal governance - Promote inclusiveness and accountability through digital tools - Launch municipal website with council decisions and budget reports - Establish WhatsApp groups for community feedback - Conduct citizen satisfaction surveys (score scale 1–5) - Promote women’s access to digital services
<b>Key Activities</b>	- Municipal website: <b>2,400 monthly visitors</b> - WhatsApp group: <b>340 active members</b> - <b>67%</b> increase in citizen participation via digital channels - Women’s participation in digital services rose from <b>10%</b> → <b>22%</b> - Citizen satisfaction improved from <b>2.3/5</b> → <b>4.1/5</b>
<b>Measurable Results</b>	- Greater transparency and accountability - Stronger gender inclusion in governance - Reinforced citizen trust in local institutions
<b>Impact</b>	- Develop a multilingual mobile application for wider citizen engagement - Introduce participatory budgeting modules - Use AI-driven sentiment analysis to monitor citizen feedback
<b>Future Perspectives</b>	

### Stakeholder Feedback and Lessons Learned

#### Municipal Leadership Perspective

Municipal Leadership Feedback: Local officials report that the new indicators provide clearer visibility into municipal strengths and weaknesses, enabling better prioritization of actions and concrete measurement of progress. Administrative Staff Perspective: Technical staff particularly value the system’s benchmarking features, which allow comparison with similar municipalities and identification of best practices.

#### Citizen Response Analysis

##### Quantitative Feedback (Survey of 247 citizens, March 2022):

- 74% report improved access to municipal information
- 68% satisfied with digital service quality
- 82% support continued digital transformation investments
- 56% actively use at least one digital municipal service

##### Qualitative Feedback Themes:

- Appreciation for reduced travel to municipal offices
- Concerns about digital literacy gaps among elderly population
- Requests for local language interface options
- Positive reception of transparent budget information access

#### Technical Staff Experience

##### Digital Skills Development Impact:

- Staff members completed digital literacy training programs
- Municipal technicians achieved intermediate proficiency in GIS tools
- Administrative staff certified in digital project management
- Operational Efficiency Gains:
  - Average document processing time: Reduced by 65%
  - Inter-departmental communication: Improved through digital collaboration tools
- Data accuracy: Increased from 78% to 94% through digital validation systems

#### Replication Framework for Other Municipalities

Based on Ouinhi’s experience, the following implementation framework emerges:

##### Phase 1: Foundation Building (6 months)

- Staff digital literacy assessment and training
- Basic internet infrastructure establishment
- Citizen awareness and engagement campaigns

##### Phase 2: Core System Implementation (8 months)

- Priority digital services deployment (tax collection, information portal)
- GIS system establishment for land management
- Performance monitoring system activation

##### Phase 3: Advanced Integration (6 months)

- Inter-municipal collaboration platform connection
- Advanced analytics and predictive modeling activation
- Citizen participation platform enhancement

## CONCLUSION

This research successfully demonstrates the feasibility and value of implementing a comprehensive Decision Support System for municipal governance assessment in Beninese municipalities. The system’s innovative approach to multi-domain assessment using a structured framework of 45 governance indicators across six comprehensive domains (Gouvernance Politique et Administrative, Gouvernance Financière, Gouvernance Participative et Genre, Gouvernance Territoriale et Foncière, Relations avec la tutelle, and Indicateurs Transversaux), temporal analysis, and interactive visualization provides municipal officials with unprecedented insights into their governance maturity progress. The comprehensive validation methodology, involving citizen respondents and municipal officials across pilot implementations, ensures the robustness and acceptability of the enhanced indicator framework. The Ouinhi case study demonstrates concrete measurable impacts: 43% improvement in tax collection efficiency, 67% increase in citizen participation through digital channels, and 65% reduction in administrative processing time. The DSS serves as the foundational infrastructure enabling advanced analytical capabilities detailed in companion studies: municipal classification through K-Means clustering analysis (yielding five distinct municipal typologies from “digitally advanced” to “digitally marginalized”) and predictive trajectory modeling using linear regression techniques (achieving R-squared values above 0.84 for short-term predictions). The systematic integration of new digital governance indicators alongside the enhancement of traditional metrics provides a comprehensive assessment framework that has proven both technically feasible and practically valuable. The replication framework derived from Ouinhi’s experience offers a structured approach for scaling implementation across all 77 Beninese municipalities, with estimated resource requirements of 25–40 million FCFA per municipality for foundational digital transformation. The preliminary results indicate significant potential for improving decision-making processes and optimizing resource allocation for digital development initiatives. The concrete evidence from Ouinhi municipality, including revenue increases of 125% in land certificate services and citizen satisfaction improvements from 2.3/5 to 4.1/5, validates the system’s practical utility beyond theoretical frameworks. The modular architecture and adaptable framework developed through this research contribute to the broader field of digital governance assessment tools, particularly for developing country contexts. The methodology and lessons learned from this implementation provide valuable insights for similar initiatives in other African countries and developing regions. Future research should focus on longitudinal impact assessment across the complete municipal network, system optimization based on expanding user feedback, and exploration of advanced analytics capabilities including predictive modeling for digital transformation trajectories. The foundation established through this work, validated through concrete implementation results and comprehensive stakeholder engagement, provides an excellent platform for continued innovation in digital governance assessment and support tools for African municipalities.

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