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REVIEWER'S REPORT

Manuscript No.: **IJAR-53458** Date: 22-08-2025

Title: Application of K-Means Algorithm for Classification of Beninese Municipalities According to Their Digital Development Profile"

Recommendation:
Accept as it is .....YES.....
Accept after minor revision.....
Accept after major revision .....
Do not accept (*Reasons below*) .....

Rating	Excel.	Good	Fair	Poor
Originality			✓	
Techn. Quality			✓	
Clarity		✓		
Significance			✓	

Reviewer Name: Mr Bilal Mir

Reviewer's Comment for Publication.

1. Overview and Relevance

The manuscript addresses the pressing issue of territorial digital disparities, with specific reference to Beninese municipalities. By applying the K-Means clustering algorithm, the study offers a systematic framework to classify municipalities based on their digital development profile. This contributes directly to the discourse on evidence-based public policy, particularly in the context of digital governance and equitable resource allocation. The research is highly relevant, bridging computational methods with socio-political applications.

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2. Abstract

The abstract effectively outlines the objectives, methodological framework, dataset characteristics, analytical approach, and key findings. It emphasizes the use of a standardized 45-indicator framework, the methodological rigor of silhouette analysis for cluster validation, and the resulting typology of municipalities into three categories. The conclusion highlights both

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methodological contribution and practical policy relevance, linking the present study to complementary works within a broader research agenda.

3. Introduction

The introduction situates the research within the context of the digital divide in developing countries, with Benin as the focal case. It underscores the heterogeneity of municipalities across departments, the limitations of traditional statistical methods, and the opportunities offered by machine learning techniques, particularly clustering algorithms, to capture multidimensional digital development patterns. The justification for employing K-Means clustering is well-articulated, linking the research to broader concerns of territorial planning and governance.

4. Methods

The methodological design is clearly described. The study draws on a comprehensive dataset comprising 20,790 data points across 45 standardized indicators collected through a Decision Support System (DSS). The application of K-Means clustering, combined with silhouette analysis for optimal cluster determination, provides a rigorous basis for unsupervised learning. The approach demonstrates both robustness in data handling and methodological precision in clustering.

5. Results

The results are presented with clarity. The clustering analysis identified three distinct profiles of municipalities:

- **Digitally advanced** (n=6, 7.8%)
- **Moderate development** (n=65, 84.4%)
- **Limited development** (n=6, 7.8%)

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The silhouette score of 0.058 is reported, showing transparency in the evaluation of clustering quality. The findings highlight that the vast majority of municipalities fall into the moderate development cluster, with small groups at both extremes representing advanced and limited development. This classification provides a meaningful typology for territorial differentiation.

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6. Conclusion

The conclusion emphasizes the study's contribution in establishing an automated methodological framework for municipal digital profile classification. It highlights the actionable insights gained for differentiated policy-making and optimized resource allocation. The study is positioned within a larger research trajectory, complementing previous work on the DSS (Article 1) and supporting predictive modeling approaches in subsequent research (Article 3). The practical applicability of the framework in policy development for the Beninese context is strongly conveyed.

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7. Presentation and Clarity

The manuscript is well-organized, with a logical flow from abstract through introduction, methods, results, and conclusion. The writing is academically appropriate, concise, and precise, ensuring accessibility to both technical and policy-oriented audiences. The linkage between computational methodology and real-world governance applications is effectively communicated.

Overall Evaluation

Criterion	Assessment
Relevance to field	High – addresses digital divide and governance in a developing country context
Conceptual framing	Strong – situates machine learning within territorial digital development analysis
Methodological rigor	High – comprehensive dataset, clustering validated by silhouette analysis
Empirical contribution	Significant – provides a novel typology of municipalities in Benin
Policy/practical contribution	Substantial – supports differentiated and evidence-based digital territorial planning

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Criterion	Assessment
Clarity of writing	Clear, coherent, and well-structured

Summary Statement

The manuscript presents a rigorous and timely study applying K-Means clustering to classify Beninese municipalities according to their digital development profiles. It integrates computational methodology with governance concerns, producing empirically grounded and policy-relevant insights. The study is conceptually strong, methodologically robust, and clearly articulated, making a valuable contribution to the fields of digital development, territorial analysis, and applied machine learning.