

# Local public expenditure and services delivery in Morocco: Efficiency analysis using the DEA Approach

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**Abstract**— this paper investigates the efficiency of local public finance in Morocco across 38 municipalities between 2019 and 2023. Grounded in the theoretical framework of New Public Management (NPM), our study combines non-parametric efficiency analysis (Data envelopment analysis and Malmquist productivity index) to capture both static and dynamic performance. The findings reveal a heterogeneous landscape. Municipalities such as Khemissat and Tan-Tan have demonstrated notable efficiency gains. On the other hand, municipalities such as M'diq-Fnideq and Oujda-Angad have experienced significant regressions. As result, our study confirms the literature on public sector efficiency established by [1, 2]. By applying frontier methodologies in a novel geographical and institutional context, our study offers empirical evidence to inform financial decentralization policies. Therefore, it proposes operational tools to support performance-based on governance in developing economies.

**Keywords**— Local public finance, New public management, Efficiency, Data envelopment analysis, Malmquist productivity index.

## I. INTRODUCTION

The science of public administration is widely acknowledged as interdisciplinary, integrating other social sciences. Furthermore, the body of knowledge in public administration remains contested, particularly regarding which academic disciplines should be considered integral to its foundation.

The most frequently proposed in the universal literature are political science, management science, legal science, and sociology. Economic science is sporadically mentioned, but without reference to its components (theories and models), which could offer a significant contribution to the current state of public administration science research.

The impetus for this study lies in the recognized importance of local finance resources in promoting financial autonomy and enhancing operational efficiency. Consequently, this research explores the relationship

between optimized local expenditures, public service provision, and their manifestation as indicators of the strength and effectiveness of local public governance. Driven by a growing interest in fundamental socio-economic issues, particularly those concerning local public authority, this research aims to examine the efficiency of local government finances. Our objective is to make a scientific contribution to the rationalization of local public expenditures and the improvement of the quality of public services as expected by citizens.

In line with this logic, our research focuses on exploring the causal nexus between the budgetary allocations of local authorities, their operational efficiency, and its effects on the public services delivery within their territorial boundaries.

Following a comprehensive review and rigorous analysis, the gap within the current literature has become apparent, thereby highlighting the stringent necessity to assess the efficiency of local finance. This conclusion arises from the fundamental requirement to secure the optimal allocation of resources and the prudent dispatching of public funds. These funds are concurrently ensuring the economic, social, and environmental viability of territorial communities. Our research focuses on the efficiency of local government finances. Consequently, we aim to offer a practical and relevant contribution. Therefore, our interdisciplinary approach allows us to analyze local financial challenges from a comprehensive perspective, integrating economic, environmental, and social dimensions.

Thus, our contribution seeks to inform policymakers and researchers about best financial practices for improving efficiency in local public expenditures. By exploring the interdisciplinary dynamics between public

finance, optimization of local expenditures, and public services delivery, we aim to broaden the scope of our contribution.

## II. STATEMENT OF THE PROBLEM

In their capacities as representatives of public power at the local scale, territorial authorities are instrumental in delivering multiple key functions to meet the distinct requirements of their populations.

The needs of the increasing academic and practical interest in the financial dynamics of local governments, this study investigates avenues for enhancing the efficiency of their financial management. The ultimate goal is to optimize public expenditures management and, consequently, improve the services delivered to citizens within their municipalities. Therefore, the focus of this research is the central inquiry into how the financial choices of elected officials can be brought into alignment with the requirements of efficiency, with the aim of encouraging sustainable long-term development.

Furthermore, the objective of our research is to determine whether the efficiency of local finances contributes to the improvement of services provided to citizens and what the impact of factors such as elected officials' decisions, fiscal capacity, and citizens' democratic participation is on the enhancement of public services within the community.

In a context of fiscal constraint and growing demand for public services, this study investigates the efficiency of local governments in converting financial resources into public service delivery. The objective is to assess the extent to which local authorities optimize their spending to achieve better outcomes for citizens.

Therefore, this research seeks to analyze and evaluate the efficiency of the finances of territorial collectivities, both by highlighting the specific challenges they confront and by promoting the development of their respective communities.

## III. LITERATURE REVIEW

### A. Theoretical review

Numerous theoretical frameworks have emphasized the significance of efficiency in the management of local communities. In this context, several major approaches can be cited. One prominent framework is the emergence of New Public Management (NPM), which is widely recognized for its potential influence on the efficiency of local government finances. The emergence of NPM is driven by a range of interrelated factors, including efforts to overcome public sector inefficiencies — as observed, for instance, in Japan — the shift toward neoliberal policy

orientations in countries such as the United Kingdom and New Zealand, responses to fiscal crises (notably in Canada), and efforts to address economic and political instability, as seen in the case of Italy.

Therefore, the fundamental principle is that we could apply and transpose the management methods in private sector to the public sector [3]. In contrast to the flexibility promoted by (NPM), the public sector is often perceived as inefficient, excessively bureaucratic, rigid, costly, focused on its own expansion (Leviathan effect), non-innovative, and possessing an overly centralized hierarchy [4].

The X-efficiency theory, introduced by [5] and later expanded by [6], is crucial to understanding the factors that cause organizations to persist and remain inefficient despite the identification of the primary source of this inefficiency, as well as the errors contributing to this dysfunction. We apply this theory to analyze how bureaucratic rigidities influence the efficiency of local public finances.

While the X-efficiency theory focuses on internal organizational inefficiencies, public choice theory [7] examines the role of political incentives in shaping public sector decisions. In our context, we draw on this theory to suggest that self-interest and electoral pressures may lead local public officials to prioritize short-term political gains over long-term financial efficiency, contributing to inefficiencies in local government finance.

Complementing our theoretical framework, we draw on Agency Theory [8], which offers a lens to understand the organization through the principal-agent relationship between citizens and elected officials. As highlighted by [9], the quality and timeliness of public services are key drivers of citizen satisfaction. Thus, sound local financial management can enhance service delivery, reinforcing the role of citizen feedback as an accountability mechanism for public spending.

### B. Empirical review

In order to provide a robust framework for the analysis of local government finance efficiency, a comprehensive literature review is deemed indispensable for the identification of salient variables and determining factors pertinent to its assessment.

Although the theoretical literature extensively considers the concept of inefficiency within decision-making units, empirical investigations focusing on the underlying determinants of this inefficiency are comparatively limited. We subsequently present several studies pertinent to the context of our analysis.

Beyond transparency, the institutional organization of

public expenditures represents a significant factor impacting its quality. Furthermore, a country's income level constitutes a variable influencing the efficiency level of nations in terms of public spending [10].

To estimate the technical efficiency of Danish municipalities, [1] employed a non-parametric method, specifically Data Envelopment Analysis (DEA), and subsequently correlated the efficiency scores of these entities with several socio-economic variables.

Effective measurement of local Government efficiency hinges on robust information management. Imperfectly shared information among decision-makers can skew decision-making processes, potentially resulting in significant inefficiencies. To address this, the authors propose decomposing overall efficiency as a relevant approach for accurately assessing organizational efficiency levels [11].

The inherent lack of competition and the monopolistic structure of public sector production can also act as disincentives for optimization and prudent resource allocation among public administration actors, a contrast observed with agents in the private sector Erkoc [12].

Building on this approach, the systematic literature review by [13] centred on investigations into the efficiency of local territorial entities and the effect of socio-demographic variables (e.g., population growth, size, density, and education levels) and economic variables (e.g., unemployment rates, per capita income, and provincial economic status) during the 1991-2016 timeframe. While for [14], they are interested to the fundamental human rights sectors: education and healthcare. their study examined the efficiency of public expenditures related to the both sectors across 37 African countries, with a benchmark within Nations in Asia and the western Hemisphere.

[15] conducted an empirical study across all French regions. In this study, they compared the reality of local public life with the tenets of agency theory and formulated recommendations for financial communication aimed at politicians seeking re-election.

[16] did a study to identify a several factors can influence the efficiency levels of sub-national government finance, including the characteristics of the served population, the external environment, monopolistic traits, and numerous other determinants.

Another strand of the literature has focused on

evaluating the efficiency of two sectors that embody fundamental human rights: education and healthcare. Indeed, in their study, Gupta and Verhoeven [14] examined the efficiency of public expenditures related to the health and education sectors across 37 African countries, comparing them with each other and with nations in Asia and the Western Hemisphere.

The study suggests that financial mismanagement, such as unauthorized, irregular, fruitless, and wasteful expenditures, negatively affects the effectiveness of territorial authorities.

Determinant factors such as socio-demographics, budgetary aspects, and political elements also exert an influence on financial efficiency. For instance, location, purchasing power parity index, tourism, unemployment rate, tax revenues, and financial independence are factors that positively impact financial efficiency, whereas personnel expenditure has a negative effect.

In a similar vein, another analysis conducted by [17] revealed issues pertaining to the financial management of local entities, such as poor service delivery, outdated revenue collection methods, and high staff turnover.

It is recommended that local authorities implement appropriate accounting systems, financial oversight, and control measures to enhance their efficiency. Furthermore, the approach of administrative and financial decentralization of local authorities can enhance the efficiency and accountability of public administration, according to the work done by [18].

From a different perspective, for [19], the economic approach of fiscal federalism posits that the decentralized provision of public services can better align with citizens' preferences and improve social welfare.

In the same framework, for [18], public choice theory justifies the importance of decentralization by rendering politicians and administrators accountable for their actions.

[17], finds that, competition among different jurisdictions can enhance the performance of local economies. However, higher-level governments present a set of constraints that can affect the political outcomes of competition among local entities (Jones 2008).

Although territorial communities are theoretically endowed with competencies and resources, it is ultimately the availability of financial means that gives concrete expression to their autonomy and self-governance.

Financial autonomy thus emerges as a sine qua non for enabling local authorities to fulfill their development mandates. However, in practice, such autonomy remains more conceptual than operational and is further constrained by legal obligations that impose compulsory expenditures, limiting the scope of discretionary financial decision-making.

#### IV. RESEARCH METHODOLOGY

Concerning the concept of efficiency, [20] was the first to distinguish between two types of technical efficiency, taking into account the nature of returns to scale.

Consequently, he introduced the notion of allocative and economic efficiency. Furthermore, a production unit is considered purely technically efficient when it demonstrates effective cooperation among the individuals working within it, and when it possesses the capacity to manage all other inputs effectively.

When a firm exhibit scale efficiency, this implies that it operates at an optimal scale. Scale efficiency involves determining whether the production unit is operating at the most advantageous size, in other words, the optimal situation that the decision-making unit can achieve by proportionally increasing the quantity of all its factors.

In the domain of sub-national government finance, financial viability, accountability, and transparency are key factors in the assessment of financial performance and position.

Moreover, the financial decisions of sub-national governments are evaluated based on criteria such as legal regularity, management practices, democratic principles, significance, scope, and budgetary cost, all to ensure the attainment of intended objectives, notably to ensure a good quality of public service delivery, an efficient management of the local finance by communities King [21].

Our analytical model is based on a robust theoretical framework, which allows for establishing linkages between the efficiency of local finance and the services delivery. The analytical methods will include a non-parametric approach, known as Data Envelopment Analysis (DEA).

Following the seminal works of Charnes et al. (1978) and Banker et al. (1984), the Data Envelopment Analysis (DEA) framework provides a non-parametric approach to assess the relative efficiency of decision-making units (DMUs) based on observed input-output combinations. In the input-

oriented CRS (Constant Returns to Scale) model, originally developed by Charnes, Cooper, and Rhodes (CCR), technical efficiency is estimated by solving the following linear programming problem:

$$\max_{\theta, \lambda} \theta \quad \text{subject to} \quad \begin{cases} Y\lambda \geq y_0 \\ \theta x_0 \geq X\lambda \\ \lambda \geq 0 \end{cases} \quad (1)$$

Here,  $x_0$  and  $y_0$  denote the input and output vectors of the DMU under evaluation, while  $X$  and  $Y$  represent the corresponding matrices for all DMUs. The vector  $\lambda$  captures the intensity variables used to construct the efficient frontier.

To account for variable returns to scale (VRS), [23] extended the CCR model by introducing a convexity constraint, leading to the BCC model. This additional constraint ensures that the reference set belongs to a convex combination of peers:

$$\sum_{j=1}^n \lambda_j = 1$$

By comparing the efficiency scores derived from the CCR and BCC models, one can isolate scale efficiency (SE), which reflects the extent to which a DMU operates at an optimal scale:

$$SE = \frac{TE_{CRS}}{TE_{VRS}} \quad (2)$$

In the present study, these models are employed to evaluate the performance of local government entities in delivering high-quality public services relative to the financial resources allocated. The CCR and BCC frameworks provide a robust means of disentangling pure technical inefficiencies from scale-related inefficiencies, thereby offering valuable insights into the operational effectiveness and scale appropriateness of territorial public service provision in Morocco.

The Malmquist Productivity Index (MPI), widely used in productivity and efficiency analysis, measures the temporal change in total factor productivity (TFP) of decision-making units (DMUs) over two consecutive periods. Following the definition based on distance functions introduced by [24], the MPI between period  $t$  and  $t + 1$  is expressed as:

Variable	Mean	SD	Min	Max	Median
TOEPc	762.74	590.36	120.70	7543.67	685.61
TCEPc	354.76	267.86	26.65	1966.57	302.37
GAS	31.47	20.30	1	100	29.82
EDC	54.36	20.90	1	100	54.86
CLS	16.00	14.56	1	100	11.24
TORI	3.66	7.66	1	100	2.19
EW	24.91	21.54	1	100	23.04

$$MPI_q(x_t, y_t, x_{t+1}, y_{t+1}) = \left[ \frac{D_t(x_{t+1}, y_{t+1})}{D_t(x_t, y_t)} \times \frac{D_{t+1}(x_{t+1}, y_{t+1})}{D_{t+1}(x_t, y_t)} \right]^{1/2} \quad (3)$$

where  $D_t(x, y)$  denotes the input distance function at time  $t$ . This index reflects the productivity shift between two periods and can be multiplicatively decomposed into two components:

$$MPI = TEC \times TCH \quad (4)$$

- TEC: Efficiency Change – capturing the movement of a DMU toward or away from the production frontier;
- TCH: Technological Change – representing the shift in the production frontier itself over time.

An MPI value greater than 1 indicates an improvement in productivity, while a value below 1 signals a deterioration.

In our empirical application, the Malmquist index is computed to assess the dynamic evolution of performance among local governments over the period 2019–2023. It allows us to disentangle gains stemming from efficiency improvements versus those attributable to technological progress in the delivery of quality public services relative to financial expenditure inputs.

## V. RESULTS AND DISCUSSION

### A. Descriptive analysis

The descriptive statistics presented for the period 2019–2023 provide an essential foundation for understanding the empirical distribution and variability of the input and output variables used in our efficiency analysis. These statistics cover 38 Moroccan provinces and prefectures and offer insights into the allocation of financial resources and the outcomes of public service provision.

Table 1. Descriptive statistics of input and output variables

Regarding inputs, Total Operating Expenditure per capita (TOEPc) shows a relatively high average (762.74) accompanied by a large standard deviation (590.36), indicating substantial disparities in current expenditure levels across DMUs. Similarly, Total Capital Expenditure per capita (TCEPc) exhibits a wide range, with a minimum of 26.65 and a maximum nearing 2000, which reflects significant differences in investment strategies among local governments.

Concerning outputs, the Education indicator (EDC) stands out with the highest average value (54.36), suggesting a strong and consistent focus on education-related spending across regions. In contrast, indicators such as Territorial Organization (TORI) reveal low mean values (3.66) but high variability, potentially highlighting uneven efforts in spatial planning. Culture and Leisure Services (CLS), though showing modest average values, demonstrate a wide range, suggesting that some regions place substantial emphasis on cultural development while others allocate minimal resources to this domain.

Overall, the high degree of variation across all variables points to considerable heterogeneity in both financial inputs and service outcomes. This justifies the adoption of a non-parametric methodology such as DEA, which does not assume homogeneity or a pre-defined functional form. Furthermore, this statistical heterogeneity must be considered in interpreting the efficiency scores and productivity changes, particularly when comparing DMUs over time.

### B. Discussion and Interpretation of finding

Table 2 reveals marked disparities in technical efficiency (CRS) evolution across the 38 DMUs. While 13 municipalities improved significantly ( $\Delta \geq +0.05$ ), 24 experienced a decline ( $\Delta \leq -0.05$ ), suggesting a general decline trend.

The most notable gain is observed in Tan-Tan (+0.835), followed by Taounate and Khemisset, consistent with convergence hypotheses and the capacity for lagging units to catch up under institutional or policy shifts. In contrast, M'diq-Fnideq and Oujda-Angad exhibit severe efficiency losses, indicative of structural inefficiencies or governance misalignment.

Overall, the results highlight dynamic shifts rather than static persistence in performance, confirming prior findings on the volatility of local public efficiency [25, 26]. Initial efficiency levels do not ensure resilience without continuous adaptation.



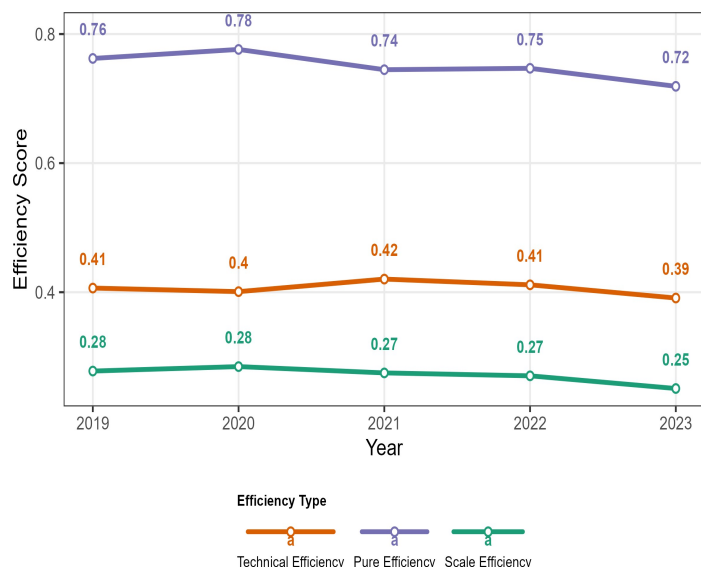


Fig. 1 Average efficiency scores evolution

In line with our core objective—assessing how local governments convert financial re- sources into effective public service delivery under fiscal constraints 1 summarizes the average DEA efficiency scores (CCR, BCC, and Scale Efficiency) across total of DMUs from 2019 to 2023.

Table 2. Developments in technical efficiency

Rang	DMUs	2019	2023	Evolution ( $\Delta$ )
1	Tan-Tan	0,159	0,994	↑ 0,835
2	Taounate	0,395	0,847	↑ 0,452
3	Khemisset	0,204	0,598	↑ 0,394
4	Mohammedia	0,182	0,243	↑ 0,061
5	Fquihbensalah	0,088	0,125	↑ 0,037
6	Sefrou	0,326	0,371	↑ 0,045
7	Agadiridaoutanane	0,040	0,091	↑ 0,051
8	Khenifra	0,186	0,283	↑ 0,097
9	Taourirt	0,231	0,300	↑ 0,069
10	Zagora	0,138	0,155	↑ 0,017
11	Rehamna	0,066	0,075	↑ 0,009
12	Tinghir	0,141	0,151	↑ 0,010
13	Essmara	0,141	0,153	↑ 0,012
14	Nador	0,393	0,380	↓ 0,013
15	Safi	0,120	0,107	↓ 0,013
16	Nouacer	0,180	0,162	↓ 0,018

17	Ouadeddahab	0,102	0,082	↓ 0,020
18	Berkane	0,107	0,100	↓ 0,007
19	Elfahs-angra	0,156	0,154	↓ 0,002
20	Tiznit	0,024	0,020	↓ 0,004
21	Azilal	0,339	0,335	↓ 0,004
22	Meknes	0,168	0,158	↓ 0,010
23	Ifrane	0,164	0,118	↓ 0,046
24	Midelt	0,148	0,104	↓ 0,044
25	Ouazzane	0,168	0,126	↓ 0,042
26	Elkelaadessraghna	0,460	0,412	↓ 0,048
27	Khouribga	0,112	0,074	↓ 0,038
28	Benimellal	0,260	0,142	↓ 0,118
29	Berchid	0,189	0,091	↓ 0,098
30	Jrada	0,312	0,161	↓ 0,151
31	Sidislimane	0,452	0,292	↓ 0,160
32	Chtoukaaitbaha	0,221	0,055	↓ 0,166
33	Alhaouz	0,656	0,498	↓ 0,158
34	Médiouna	1,000	0,816	↓ 0,184
35	Kénitra	0,753	0,402	↓ 0,351
36	Oujda-angad	0,734	0,163	↓ 0,571
37	Inezganeaitmelloul	0,045	0,045	0,000
38	M'diq-Fnideq	1,000	0,149	↓ 0,851

Note: Scores TE\_CRS (Technical efficiency under constant return to scale).

↑ Significant improvement ( $\Delta \geq +0.05$ ) | ↓ Significant degradation ( $\Delta \leq -0.05$ )

The observed gap between Pure Technical Efficiency (PTE) and Technical Efficiency (TE) underscores scale-related inefficiencies as the dominant source of suboptimal performance. While PTE remained relatively high (0.74–0.78), TE stagnated below 0.42, and Scale Efficiency (SE) declined steadily from 0.28 to 0.25. These results, consistent with the previous table, highlight a structural misalignment between the scale of operations and optimal resource deployment.

The slight drop in all three indicators in 2023 may reflect mounting fiscal pressures, reinforcing findings from [27] on the limits of efficiency gains in resource-constrained public systems. Hence, efficiency losses appear less related to managerial slack and more to structural or institutional constraints, validating our initial hypothesis.

The integration of the Malmquist index, in addition to the static assessment presented above, enables us to deepen the dynamic analysis of local authority performance over the 2020-2023 period. In line with our problematic, this approach aims to distinguish trajectories of efficiency, technological progress and total factor productivity in a con- text of differentiated public governance.

Tiznit	0,985	1,016	1,000	0,927	0,770	0,714	DR
Tan-tan	1,159	1,011	1,172	0,998	0,995	0,994	DR
Essmara	1,000	1,197	1,197	1,000	0,924	0,924	EMS
Ouadeddhab	1,062	1,000	1,062	0,995	1,002	0,996	CFGE

**Note:** Les valeurs MPI >1 Indicate an improvement in productivity. Codes: GMRT (Progress in management/technologie), DR (Double regression), CFGE (favorable context), PMT (Managerial progress), EMS (Stabilité mixte).

The table 3 reveals significant disparities: some communities, such as Jrada, Béni Mellal or Mohammedia, show a clear improvement in their productivity (MPI > 1), reflecting managerial or technological adaptation efforts. Conversely, there were cases of marked regression, notably in Khouribga and Chtouka Aït Baha, suggesting a decline in efficiency or structural contextual constraints. This heterogeneity, consistent with the static diagnoses, underlines the decisive role played by local dynamics of governance and resource allocation in the production of public services.

Table 3. Analysis of Malmquist Index-Comparative performance

DMU	2020			2023			Interpretation
	TEC	TCH	MPI	TEC	TCH	MPI	
Mdiq-fnideq	0,071	0,942	0,067	0,944	0,814	0,769	GMRT
Elfahs-angra	1,511	1,024	1,548	0,739	0,980	0,725	DR
Ouazzane	1,004	0,955	0,958	0,877	0,998	0,875	CFGE
Oujda-angad	0,626	1,126	0,705	0,638	0,892	0,569	GMRT
Nador	0,757	0,846	0,640	0,839	0,997	0,836	PMT
Jrada	0,332	1,041	0,346	1,245	1,013	1,261	GMRT
Berkane	1,502	1,019	1,531	1,018	0,998	1,016	DR
Taurirt	1,000	1,251	1,251	1,000	1,270	1,270	EMS
Meknes	1,107	0,992	1,098	1,074	1,002	1,076	CFGE
Ifrane	1,102	0,935	1,031	0,947	0,770	0,730	DR
Sefrou	0,766	1,330	1,019	1,000	1,001	1,001	GMRT
Taounate	1,394	1,817	2,533	1,200	1,002	1,202	DR
Kénitra	0,213	1,321	0,281	1,168	1,000	1,168	GMRT
Khemisset	2,288	0,897	2,052	1,000	1,141	1,141	CFGE
Sidislmane	0,546	0,955	0,522	1,046	0,997	1,043	PMT
Benimellal	0,602	1,006	0,606	1,170	1,015	1,188	PMT
Azilal	0,922	0,983	0,907	1,066	0,999	1,064	PMT
Fquihbensalah	1,478	1,025	1,515	1,178	0,999	1,176	DR
Khenifra	4,614	0,663	3,062	0,435	0,882	0,383	CFGE
Khouribga	4,344	1,130	4,909	0,318	0,779	0,248	DR
Mohammedia	0,665	1,227	0,816	1,726	0,880	1,519	GMRT
Nouacer	1,054	1,014	1,069	0,935	1,039	0,971	CFGE
Médiouna	0,638	0,864	0,551	0,916	0,891	0,816	PMT
Berchid	0,756	1,066	0,806	0,812	0,995	0,808	GMRT
Alhaouz	1,234	1,236	1,525	1,099	0,903	0,992	DR
Elkelaadessraghna	1,087	0,973	1,058	1,027	0,969	0,995	DR
Rehamna	1,551	0,882	1,368	1,029	0,910	0,936	CFGE
Safi	1,309	1,098	1,436	1,216	0,997	1,213	DR
Midelt	0,921	0,825	0,760	0,938	0,949	0,890	PMT
Tinghir	1,054	0,668	0,704	1,081	1,029	1,112	PMT
Zagora	0,894	1,032	0,923	0,995	1,155	1,149	PMT
Agadiridaoutanane	2,342	0,971	2,274	1,901	0,975	1,853	CFGE
Inezeganeaitmelloul	1,201	0,805	0,967	0,935	1,089	1,018	CFGE
Chtoukaaitbaha	3,505	1,290	4,523	0,661	0,621	0,411	DR

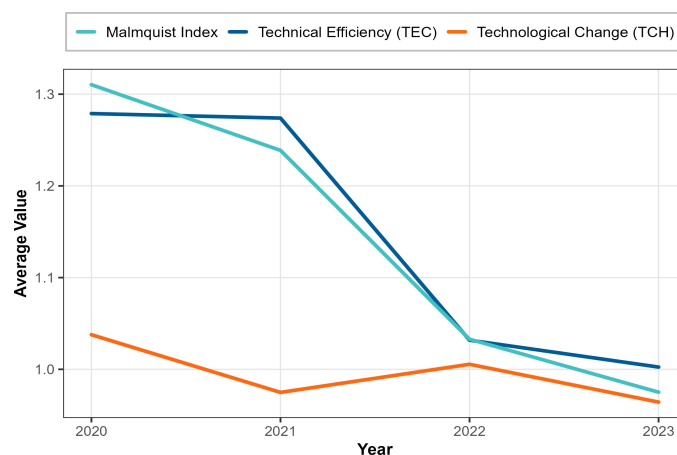


Figure 2 Evolution of mean TEC, TCH and Malmquist Index

The line chart 2 reveals a clear decline in average productivity (MPI), technical efficiency change (TEC), and technological change (TCH) between 2020 and 2023. The MPI decreased from 1.31 to 0.97, indicating an overall deterioration in total factor productivity.

TEC followed a similar pattern, remaining stable until 2021 before declining sharply in 2022. TCH, consistently below 1, reflects weak technological progress throughout the period.

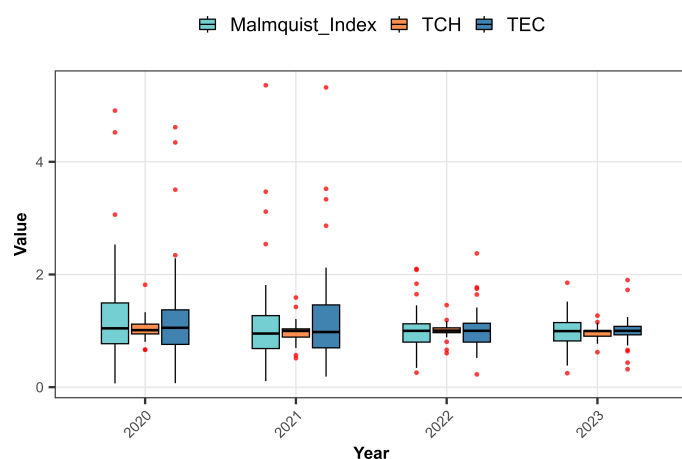


Figure 3 Annual distribution of REC, TCH and Malmquist Index

The figure 3, showing the distribution of these indices, confirms this trend. Wider dispersion and outliers in 2020–2021 suggest heterogeneity in local performance, possibly driven by uneven crisis responses.

By 2023, distributions appear more compact, hinting at convergence—but at lower efficiency levels. These results echo findings from [2, 28], who stress the fragility of local productivity under fiscal constraints.

The persistent lag in TCH may reflect structural limitations in technological uptake, especially among under-resourced municipalities—consistent with [29] on digital and institutional asymmetries. The decline in TEC post-2021 may signal the exhaustion of managerial adaptation capacity following COVID-19 shocks. The apparent convergence suggests either harmonization or systemic limitations curbing differentiation in performance. Overall, the MPI trends highlight the need for renewed policy efforts—balancing efficiency incentives with structural investments—to sustain long-term gains in public service delivery.

## VI. CONCLUSION

This study provides a novel and comprehensive assessment of local government efficiency in Morocco by combining static models with dynamic Malmquist productivity analysis over the 2019–2023 period. In a context of growing demand for public services and fiscal constraints, our findings reveal substantial heterogeneity in technical efficiency and productivity evolution across municipalities. While some local authorities demonstrate progress through managerial adaptation or technological adoption, the overall decline in Malmquist indices—especially post-2021—signals a concerning erosion of performance, likely exacerbated by structural and institutional frictions.

By integrating both cross-sectional and longitudinal perspectives, this research contributes original empirical evidence to the underexplored field of local public finance in developing contexts, and constitutes the first study of its kind in Morocco. It offers critical insights for policymakers aiming to strengthen governance mechanisms and resource allocation frameworks at the subnational level. Nonetheless, this study is not without limitations.

The non-parametric nature of DEA, while flexible, does not account for statistical noise or unobserved heterogeneity. Future work will address this by incorporating Stochastic Frontier Analysis (SFA) to validate efficiency scores under parametric assumptions. Additionally, we plan to enrich our assessment with spatial distributional analyzes to capture territorial patterns and inequalities, and with econometric modeling to identify the key determinants of efficiency across municipalities.

Overall, this work lays the groundwork for a more evidence-based approach to local public financial management and opens promising avenues for robust, policy-relevant efficiency diagnostics in emerging economies.

## REFERENCES

- [1] Bruno De Borger and Kristiaan Kerstens. “Radial and Nonradial Measures of Technical Efficiency.” In: *Journal of Productivity Analysis* (1996).
- [2] António Afonso and Sónia Fernandes. “Assessing Local Government Efficiency.” In: *Economics Working Papers* (2008).
- [3] Gemma Pérez-López, Diego Prior, and José L. Zafrá-Gómez. “Rethinking New Public Management Delivery Forms and Efficiency: Long-Term Effects in Spanish Local Government.” In: *Journal of Public Administration Research and Theory* 25.4 (Oct. 2015), pp. 1157–1183. ISSN: 1053-1858, 1477-9803. DOI: [10.1093/jopart/muu088](https://doi.org/10.1093/jopart/muu088).
- [4] Anne Amar-Sabbah. “Le Nouveau Management Public : Avantages et Limites.” In: *Gestion & Management Public, Recemap* (2007).
- [5] Harvey Leibenstein. “Allocative Efficiency vs. X-Efficiency.” In: *The American Economic Review* 56.3 (1966), pp. 392–415. URL: <https://www.jstor.org/stable/1823775>.
- [6] Harvey Leibenstein and Shlomo Maital. “The organizational foundations of X-inefficiency: A game-theoretic interpretation of Argyris’ model of organizational learning.” In: *Journal of Economic Behavior & Organization* 23.3 (Feb. 1994), pp. 251–268. ISSN: 01672681. DOI: [10.1016/0167-2681\(94\)90001-9](https://doi.org/10.1016/0167-2681(94)90001-9).
- [7] James M Buchanan and Gordon Tullock. *The calculus of consent: Logical foundations of constitutional democracy*. Vol. 100. University of Michigan press, 1965.
- [8] Michael C. Jensen and William H. Meckling. “Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure.” In: *Journal of Financial Economics*



- 3.4 (1976), pp. 305–360. DOI: [10.1016/0304-405X\(76\)90026-X](https://doi.org/10.1016/0304-405X(76)90026-X).
- [9] Abhinandan Kulal et al. “Enhancing public service delivery efficiency: Exploring the impact of AI.” In: *Journal of Open Innovation: Technology, Market, and Complexity* 10.3 (2024), p. 100329.
- [10] Emilie Caldeira et al. “La qualité de la dépense publique dans les pays en développement: mesure et déterminants.” In: *Revue d'économie du développement* 29.1 (2021), pp. 51–76. DOI: [10.3917/edd.291.0051](https://doi.org/10.3917/edd.291.0051).
- [11] Ezzeddine Mosbah, Lokman Zaibet, and P. Sunil Dharmapala. “A new methodology to measure efficiencies of inputs (outputs) of decision making units in Data Envelopment Analysis with application to agriculture.” en. In: *Socio-Economic Planning Sciences* 72 (2020), p. 100857. ISSN: 00380121. DOI: [10.1016/j.seps.2020.100857](https://doi.org/10.1016/j.seps.2020.100857).
- [12] Taptuk Emre Erkoc. “Efficiency of Public Sector Organizations: Perspectives from Theories of Bureaucracy.” In: *International Journal of Public Administration* 36.1 (2013), pp. 23–41. DOI: [10.1080/01900692.2012.730191](https://doi.org/10.1080/01900692.2012.730191).
- [13] Isabel Narbón-Perpiñá and Kristof De Witte. “Local governments’ efficiency: a systematic literature review—part I.” en. In: *International Transactions in Operational Research* 25.2 (2018), pp. 431–468. ISSN: 0969-6016, 1475-3995. DOI: [10.1111/itor.12364](https://doi.org/10.1111/itor.12364).
- [14] Sanjeev Gupta and Marijn Verhoeven. “The efficiency of government expenditure: experiences from Africa.” In: *Journal of Policy Modeling* 23.4 (2001), pp. 433–467. ISSN: 01618938. DOI: [10.1016/S0161-8938\(00\)00036-3](https://doi.org/10.1016/S0161-8938(00)00036-3).
- [15] Muriel Michel-Cuplot and Serge Rouot. “Communication financière des collectivités locales. L’apport de la théorie de l’agence au politique.” In: *Revue française de gestion* 40.245 (2014), pp. 55–70. ISSN: 03384551. DOI: [10.3166/rfg.245.55-70](https://doi.org/10.3166/rfg.245.55-70).
- [16] Mark Smith. “It Really Does Depend: Towards an Epistemology (and Ontology) for Everyday Social Pedagogical Practice.” In: *International Journal of Social Pedagogy* 9.1 (Nov. 2020). ISSN: 2051-5804. DOI: [10.14324/111.444.ijsp.2020.v9.x.018](https://doi.org/10.14324/111.444.ijsp.2020.v9.x.018).
- [17] Zachary D. Liscow. “The Efficiency of Equity in Local Government Finance.” In: *New York University Law Review* 92.6 (2017), pp. 1828–1860.
- [18] David R. Agrawal, William H. Hoyt, and John D. Wilson. “Local Policy Choice: Theory and Empirics.” en. In: *CESifo Working Paper Series* 8647 (Oct. 2020). URL: [https://www.cesifo.org/DocDL/cesifo1\\_wp8647.pdf](https://www.cesifo.org/DocDL/cesifo1_wp8647.pdf).
- [19] O. Malinovska and A. Revutskyi. “Theoretical basics of the efficiency of the functioning of local government bodies.” In: *Balanced Nature Using* 3 (July 2022), pp. 70–77. ISSN: 2310-4678. DOI: [10.33730/2310-4678.3.2022.266561](https://doi.org/10.33730/2310-4678.3.2022.266561).
- [20] M. J. Farrell. “The Measurement of Productive Efficiency.” In: *Journal of the Royal Statistical Society. Series A (General)* 120.3 (1957), p. 253.
- [21] David King. *Local Government Economics in Theory and Practice*. 1st ed. London: Routledge, 2022. ISBN: 978-1-00-327181-9. DOI: [10.4324/9781003271819](https://doi.org/10.4324/9781003271819).
- [22] Abraham Charnes, William W. Cooper, and Edward Rhodes. “Measuring the efficiency of decision making units.” In: *European Journal of Operational Research* 2.6 (1978), pp. 429–444.