African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 31 Aout 2025

Regional Inequality in Morocco: A Bibliometric Analysis of AI and Education as Drivers for Reducing Inequality.

Auteur 1 : El Houssin OUASSOU.
Auteur 2 : Boutaina ISMAILI IDRISSI.

El Houssin OUASSOU, (https://orcid.org/0000-0002-3433-862X *, PhD Candidate)
Faculty of Law, Economics & Social sciences of Agdal, Mohammed V University in Rabat, Rabat, Morocco

Boutaina ISMAILI IDRISSI, (https://orcid.org/0000-0001-6478-7816 *, Research professor)
Faculty of Law, Economics & Social sciences of Agdal, Mohammed V University in Rabat, Rabat, Morocco

Déclaration de divulgation : **L'auteur n'a pas connaissance de quelconque financement qui pourrait affecter l'objectivité de cette étude.**

Conflit d'intérêts : **L'auteur ne signale aucun conflit d'intérêts.**

Pour citer cet article : **EL HOUSSIN .O & ISMAILI IDRISSI .B (2025) « Regional Inequality in Morocco: A Bibliometric Analysis of AI and Education as Drivers for Reducing Inequality », African Scientific Journal « Volume 03, Numéro 31 » pp: 1091 – 1117.**

DOI : 10.5281/zenodo.16966732

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 31 Aout 2025

Abstract

The current research presents a bibliometric analysis of emerging methodologies applied to the study of regional inequality in Morocco, with particular emphasis on artificial intelligence (AI), remote sensing, and education. Using bibliographic data collected from Scopus and Web of Science, the study maps the intellectual structure of the field by analyzing publication trends, citation networks, influential authors, and evolving thematic clusters. The findings reveal a notable global shift toward the adoption of advanced computational tools—such as machine learning, deep learning, big data analytics, and geospatial technologies—for monitoring and analyzing spatial disparities. However, Moroccan academic contributions remain relatively limited within this rapidly evolving research domain.

A key insight emerging from the analysis is the increasing integration of education as a critical variable in spatial inequality research. Unequal access to quality education, particularly in rural and marginalized areas, is widely recognized as a major factor sustaining territorial divides. Conversely, innovative educational strategies—including digital learning platforms, vocational training, and lifelong education—are frequently identified as mechanisms for fostering regional convergence and inclusive development.

This bibliometric mapping underscores the growing recognition of interdisciplinary approaches that combine technological innovation with social policy insights. It calls attention to the urgent need for Morocco to enhance its research capacity and policy design through greater investment in AI-driven, education-focused strategies. By identifying existing gaps and emerging opportunities, this study offers a methodological foundation for future research and policymaking aimed at promoting spatial equity and territorial cohesion in Morocco and comparable settings.

Keywords: Regional Inequality, Education, Artificial Intelligence, Morocco, Bibliometric

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 31 Aout 2025

1. Introduction

Regional inequality [1]remains a persistent global challenge, affecting economic development, access to services, and quality of life. As noted by Stiglitz (2012), such disparities are rooted not only in market dynamics but also in institutional and structural systems that shape the distribution of resources and opportunities. These issues are particularly pronounced in developing countries, where limited access to education, healthcare, and employment hampers inclusive growth. In Morocco, spatial disparities are historically entrenched, with development concentrated in urban centers while rural areas remain marginalized (Sahibi & Hamzaoui, 2017). Previous research has emphasized imbalances in education, infrastructure, and labor market access as key drivers of regional inequality (Bakour & Abahamid, 2019). However, these studies often rely on conventional methods, overlooking recent technological advances in spatial analysis. For example, El Ansari (2009) demonstrated that the growth model of Morocco is geographically uneven, causing concentration of wealth, employment and infrastructure in some areas (Bakour and Abahamid 2019). Additionally, inter-regional inequalities persist despite the progress at the national level, with human capital and infrastructure playing a significant role in reducing these disparities (Sahibi and Hamzaui 2016, 2017).

It is necessary to go beyond the traditional point of view, to close the understanding of the frequent regional inequalities in Moroccan with innovative analytical approaches. Although several studies have identified historical, economic and infrastructure as prominent factors that affect regional imbalances, often depend on conventional methods to analyze these patterns. However, to completely understand the multifaceted nature of spatial inequality, particularly the crucial role of education as a mediating factor, there is a growing need to incorporate more advanced techniques and data -based methods.

Despite the growing adoption of machine/deep learning, remote sensing for spatial analysis, many developing countries such as Morocco continue to have a significant gap to understand the role of education and the complex interaction with regional inequalities. Existing studies have focused on large -scale econometric models (Amaghouss & Ibourk 2020; Ibourk &

[1] In the context of this research, regional inequality refers to uneven distribution of resources, economic opportunities and development consequences in various geographical regions of the country. This inequality appears in various forms, such as difference in income levels, entre to quality healthcare services, education, infrastructure and employment opportunities. Major cities such as Moroccan's urban areas, especially Casablanca, Rabat and Marrakesh have seen historically high level of investment and economic activity, resulting in better standard of living and essential services. In contrast, in rural areas, especially the Atlas Mountains and in the eastern parts of the country, often experience limited access to these benefits, leading to significant socio-economic gap.

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 31 Aout 2025

Amaghouss 2014; Ibourk & Raoui 2021), with a less view to the potential use of advance method for forecasting, mapping, exploration of inequality. In addition, although education is widely recognized as an important factor in determining regional inequalities (Ibourk & Amaghouss 2014; Salhi, Boujrouf & Gourfi 2023), their role as a mediator in the reduction of spatial inequality remains unused.

This research aims to provide a comprehensive bibliometric assessment of how emerging technologies—particularly artificial intelligence (AI), remote sensing, and machine/deep learning—have been applied to study regional inequality, with a focus on the Moroccan context. Special attention is given to the underexplored role of education as a mediating factor in spatial inequality. By analyzing thematic clusters, citation patterns, and collaboration networks, the study seeks to identify research gaps and inform future data-driven approaches to regional development.

The remaining part of this research is structured as follows: Section 2 shows the relevant literature review, while Section 3 illustrate the research methodology, including data collections and qualitative review processes. Section 4 presents the results of the analysis, mapping the identified major research groups and trends. Section 5 discuss the implications of the findings, highlighting gaps in current research and proposing directs for future studies. Finally, Section 6 concludes the paper.

2. Literature Review

Industrial diversification[2] plays a key role in addressing regional inequality in Morocco, where economic activity remains highly concentrated in specific urban and industrial hubs, leaving many regions underdeveloped. As Bun and El Makhloufi (2007) found, specialization and diversity in industrial sectors positively impact local growth. In Morocco, industrial activity is unevenly distributed, with regions such as *Casablanca-Settat* and *Rabat-Salé-Kénitra* benefiting from diversified industrial bases, while remote and rural areas remain dependent on agriculture and low-value economic activities. The mining sector, particularly phosphate extraction, is a major economic driver, contributing significantly to GDP, exports, and employment. However, as Leila, Loubna, and Ali (2021) highlight, the sustainability of resource-dependent industries raises concerns, as mining activities are often concentrated in

[2] The importance of industrial diversification in reducing regional economic disparities cannot be overstated. While Morocco's dependence on specific sectors, such as phosphates and tourism, has driven growth in certain regions, it has also exposed the limitations of regional economies that lack diversification. A broader industrial diversification strategy Zreik, M. (2024), could alleviate persistent inequalities by creating jobs and fostering local economic growth in rural and underserved areas, thereby promoting more balanced regional development.

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 31 Aout 2025

specific regions, such as *Khouribga* and *Benguerir*, creating localized growth but failing to stimulate broader regional development. Without a balanced industrial diversification strategy, disparities between resource-rich and economically lagging regions are likely to persist, reinforcing spatial inequalities in Morocco.

Morocco's geographic disparities are evident in the urban-rural division, with 70% of the poor living in rural areas (Boutayeb, 2006). Limited access to education, healthcare, and infrastructure exacerbates these disparities, particularly affecting rural women.

Remittances have improved rural living standards but remain underutilized due to limited financial access (De Haas, 2006, 2009). Poor governance and weak infrastructure further hinder rural integration with urban markets (Boutayeb, 2006). While, the New Development Model (NDM) seeks to reduce spatial inequalities through economic diversification, human capital enhancement, and social inclusion (HCP, 2021). However, rural small businesses face challenges in accessing finance and global markets.

While, education plays a crucial role in reducing regional disparities and fostering inclusive economic growth in Morocco. Unequal access to education, particularly vocational training, has been identified as a key driver of socio-economic inequality (Ibourk & Amaghouss, 2014). Rural areas face challenges such as inadequate infrastructure and limited training programs, exacerbating unemployment and hindering economic development. Higher education disparities also persist, with urban centers benefiting from better-equipped institutions and higher-quality education, while rural regions struggle with resource limitations (Hoel, 2013). These inequalities contribute to differences in skill acquisition and employment opportunities, reinforcing regional economic divergence. Nevertheless, introducing policies like the Strategic Vision for 2015-2030 to improve education equity and reduce dropout rates. However, areas such as *Marrakech-Safi* and *Beni Mellal-Khénifra* continue to report high illiteracy and dropout rates, outlining the need for field-specific reforms (Ibourk & Raoui, 2025).

In response to these educational disparities, policy initiatives such as conditional cash transfer programs have improved school enrollment in high-risk sectors, but requires expansion and better alignment with regional needs (Ibourk and Raoui, 2025). Spain and China lessons throw light on how field-specific educational investment, such as lifetime learning programs and competitive higher education strategies have reduced regional inequalities (McGowan & San Millán, 2019; Sun et al., 2024). Although education plays an important role in defining spatial inequalities, addressing these inequalities effectively requires a multidimensional approach that integrates technological progress (Mathane, Gumbo & Makoni 2024; Mishra et al., 2023).

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 31 Aout 2025

In this context, technological innovation arises as a critical tool, recent development in AI, particularly ML and DL, have proven to be valuable to analyze spatial inequality, economic disparities and environmental risks (Khan. 2019). These technologies provide information propelled for the regional plan and policy intervention. ML technology, such as random forest (RF) and XGBoost, has been widely implemented to predict environmental risks. In the *Ourika* basin of Morocco, the RF and XGBoost models acquired high precision (> 99%) in the mapping of flood sensitivity, which support the regional plan (Meliho et al. 2022). The risk of flooding affects the underdeveloped areas with weak infrastructure, and similar models have successfully identified areas affected by floods in *Tetouan* and *Rheraya*, which help reduce economic failures related to disaster (Elghouat et al., 2024; Wassima et al., 2024). Additionally, ML has been used to analyze forest erosion in *Bouskoura* district in Morocco, revealing significant disadvantages associated with regional economic inequalities, since environmental decrease often deteriorates socio-economic vulnerabilities (Simou et al., 2024). The soil carbon stock prediction has further improved the evaluation of the sector affected by erosion, supporting agricultural productivity to address rural economic imbalance (Mosaid et al., 2024).

Al Haouz-Mejjate uses deep learning techniques in aquifer mapping, which improves the management of water resources in dry areas, where water scarcity increases rural-urban inequalities (El Mezouary et al., 2024). AI models like RF and XGBoost have also mapped the sensitivity of forest fire in North Morocco, which provides insight for disaster mitigation in economically weak areas that lack resources for effective climate adaptation (Seddouki et al., 2023).

Additionally, satellite imagery, geospatial artificial intelligence (GeoAI), and remote sensing have become essential tools in analyzing regional inequalities and urban-rural inequalities. Night-time light (NTL) used as reliable proxy in socio-economic research, which reveals inequalities in GDP distribution. For example, VIIRS NTL data in Egypt highlighted the stark regional economic differences (Hasham et al., 2024), while research on China's "Belt and Road" area identified economic inequalities in the multiscale level (Yang et al, 2024). Similarly, deep learning model implemented the success of multispectral satellite imagery map in Africa, which explained 70% of spatial variations (Yeh et al., 2020).

Expanding this capacity, GeoAI equipment improves poverty and public service distribution analysis. The Convolutional Neuronal Network (CNN or ConvNets) in combination with satellite images improved poverty measurements, offering high concept estimates in 213 sub - classes in China (Chang et al., 2023). The AI model has also been used to evaluate inequalities

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 31 Aout 2025

in public services; For example, the Chinese Night Light Development Index (NLDI) determined the infrastructure gaps (Xu et al., 2015). Remote sensing images map the earth's use pattern and help in analyzing urban-rural inequality. Landsat images identified urban expansion and a significant difference in rural development in Megaregions (Qin et al., 2023) of China.

3. Research Methodology

This research uses a comprehensive bibliometric analysis of current literature, in particular, it assesses whether education can contribute to reducing spatial inequalities and using AI-based techniques to reduce structural challenges.

This research adopts a post-positivist epistemological stance, grounded in the belief that objective patterns and trends in scientific knowledge can be observed and measured, while also acknowledging the influence of context, interpretation, and systemic structures. The study follows a hypothetico-deductive mode of reasoning, beginning with the assumption that emerging technologies—particularly artificial intelligence, remote sensing, and education—are increasingly shaping regional inequality research. To investigate this, the research employs bibliometric analysis as its primary methodological approach. This quantitative technique allows for the systematic mapping of academic literature through the examination of publication trends, citation patterns, and thematic clusters. The remaining of the section underlines the systematic approach adopted for identification, analysis and synthesis of relevant literature.

3.1. Equipment for Bibliometric Analysis

In this research, various equipment were employed. First, Biblioshiny was developed by Aria and Cuccurullo (2017), a software that is known for its strong abilities in creating descriptive figures, exploring emerging trends, selected as a suitable tool for this research. Additionally, a widely recognized software for VosViewer (Van Eck and Waltman 2010), is used to map and analyze the complex network of literature. To further increase the data analysis and visualization process, PowerBI and R were also included. PowerBI was used for its advanced data visualization capabilities, for easy interpretation of interactive dashboards and complex datasets, R was used for data processing, statistical modeling and analytical results.

3.2. Organized approach to bibliometric analysis

The research method follows a systematic and structured approach. To guarantee generalized coverage of relevant literature, data was collected from scopus and WOS database. From 2014 to 2024, publishing coverage (starting from March 3, 2025). Both databases were selected for their strong reputation by covering the work of high-quality academics. However, scopus was priority due to extensive coverage of recent academic documents, ensuring more update and

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 31 Aout 2025

diverse data sets. While WOS is recognized by its complete citation tracking, especially in areas of spatial economics, regional development and artificial intelligence applications, provides better inclusion by indexing a wide range of magazines.

Table 1: Search Queries used in Scopus and Web of Science (WOS) for data collection

Parameters		Criteria
Logical Statement	Field 1	ALL (("spatial" OR "regional" OR "geographic" OR "socio-spatial" OR "urban-rural" OR "territorial")
	Field 2	AND ("inequality" OR "disparity" OR "polarization" OR "agglomeration" OR "exclusion" OR "economic mobility" OR "social mobility" OR "spatial segregation" OR "spatial justice" OR "regional convergence" OR "regional divergence" OR "spatial spillovers" OR "center-periphery" OR "spatial dependence" OR "skills mismatch" OR "knowledge diffusion" OR "education and regional growth" OR "education and labor markets")
	Field 3	AND ("machine learning" OR "deep learning" OR "neural networks" OR "artificial intelligence" OR "convolutional neural networks" OR "recurrent neural networks" OR "support vector machines" OR "random forests" OR "gradient boosting" OR "reinforcement learning" OR "computer vision" OR "geospatial artificial intelligence" OR "spatial data mining" OR "pattern recognition" OR "clustering algorithms" OR "genetic algorithms" OR "fuzzy logic" OR "decision trees" OR "k-nearest neighbors" OR "ensemble methods" OR "long short-term memory" OR "classification algorithms" OR "image segmentation" OR "predictive modeling" OR "big data analytics")
	Field 4	AND ("education" OR "educational attainment" OR "human capital" OR "schooling" OR "vocational training" OR "lifelong learning" OR "higher education" OR "STEM education" OR "educational access" OR "education policies" OR "digital education" OR "skills development" OR "technical education" OR "online learning"))
	Field 5	AND (LIMIT-TO (AFFILCOUNTRY, "Morocco"))
	Restrictions	AND (LIMIT-TO (PUBSTAGE, "final")) AND (LIMIT-TO (SUBJAREA, "SOCI") OR LIMIT-TO (SUBJAREA, "ECON"))

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 31 Aout 2025

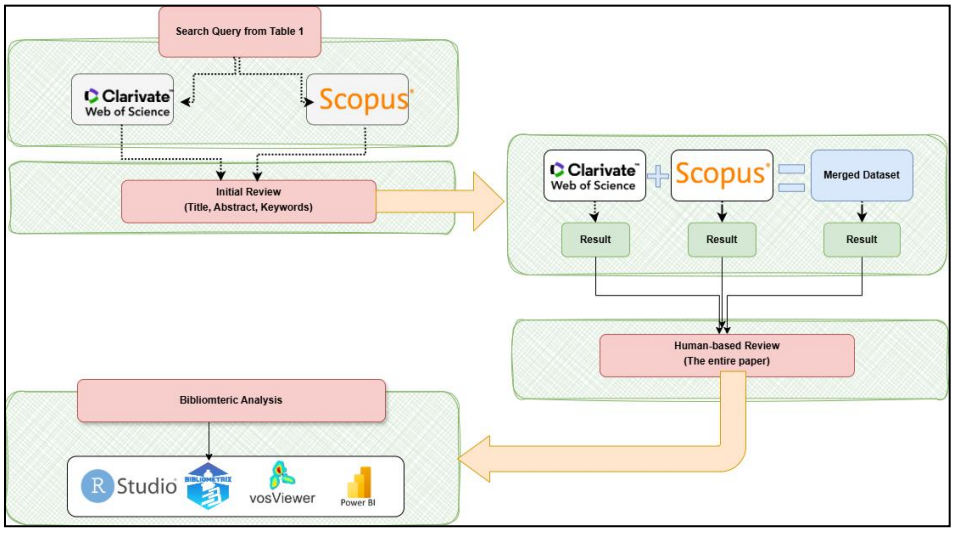
		AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (LANGUAGE, "English"))
Insertion		The document is published in the Scopus or Web of Science databases; The document contains the keywords of interest;
Elimination		The document is not in English; The document type is not a journal article;
Human-based review		Manual review of the entire paper.

Source: Author's Contribution

This structure establishes a solid base through the use of a joint version from scopus and WOS (after removing duplicates), so that leading contribution, emerging subjects and future research orients can be identified. In line with previous literature (AlRyalat et al., 2019; Echchakoui, 2020).

To guarantee accuracy in this process, the search strategy uses a structured boolean logical approach (and, or), see **Table 1** for more details. The search query is systematically designed to include four interconnected areas, which allows regional inequality, education and detailed discovery of literature at the intersection of AI -based techniques. The investigation follows the flow diagram described in **Figure 1**.

Figure 1: Schematic representation strategy employed



Source: Author's Contribution

Field 1: Spatial inequality

This field ensures the retrieval of studies discussing regional disparities, urban-rural inequality, geographic exclusion, and socio-spatial polarization—all of which are crucial to understanding spatial inequality in Morocco.

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 31 Aout 2025

Field 2: Mechanisms of spatial inequality

This field identifies the mechanisms and consequences of spatial inequality, including: Spatial dependence and spillovers, which highlight how regional disparities persist over time. Regional divergence vs. convergence, which relates to whether regions are growing together or apart. Skills mismatch and knowledge diffusion, which tie directly to education's role in reducing inequality by improving human capital allocation in labor markets. This ensures the theoretical grounding of the research is well represented in the literature retrieved.

Field 3: Artificial intelligence-based techniques

This field ensures that the AI-driven methodology is well-represented in the literature by incorporating: ML and DL methods for predicting spatial inequality trends. Geospatial AI and spatial data mining for analyzing patterns from satellite imagery. Computer vision and image segmentation, which can be used to analyze urban expansion, infrastructure, and regional development. By including these terms, the search retrieves cutting-edge AI-driven approaches to studying spatial inequalities.

Field 4: The role of education

Since the research focuses on education as a mediator, this field ensures that retrieved literature covers: Education's effect on regional economic development (e.g., "education and regional growth"). Education's role in labor markets (e.g., "skills development," "vocational training"). Policy interventions (e.g., "education policies," "higher education") to reduce spatial disparities. This ensures a comprehensive exploration of education's influence on regional inequalities.

Field 5: Geographic scope of Morocco

This limits the search to studies specific to Morocco, ensuring the findings directly contribute to the Moroccan context rather than general global trends.

By integrating these four fields with carefully selected keywords and Boolean operators, the search query ensures a comprehensive and systematic retrieval of relevant studies. It captures diverse dimensions of inequality, examines various forms of migration, considers their interplay with recent crises, and optionally incorporates a broader human-centered perspective. This multi-faceted approach enhances the likelihood of identifying research that explores the complex intersections of these critical issues.

3.3. Evaluation of bias and rigor

A rigorous selection process is essential for identifying relevant journal articles for this research. To achieve this, a two-step approach is implemented. First, articles are selected based on pre-defined inclusion criteria (see **Table 1**), ensuring that they: (i) are published in reputable

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 31 Aout 2025

academic databases (Scopus and WoS), (ii) are peer-reviewed journal articles, (iii) are published in their final form, (iv) are thematically relevant to the research focus on migration, inequality, and recent crises, and (v) are written in English. The articles that do not meet these criteria, including non-English publications and other document types (eg, book chapters, conference proceedings), will be excluded.

Beyond the selection criteria, the process also prioritizes the rigor and bias evaluation to guarantee the reliability of the selected items. This implies an in -depth evaluation of the research method, in which inclusion criteria naturally improve the selected research. Additionally, a human-based review process provides an additional layer of investigation, assessing potential biases in essence of the article. This dual layered approach, combining the structured selection norms with careful manual review, strengthens the strength and reliability of the research findings.

4. Results and Findings

This section presents the key major insights by identifying trends, major sources and authors, country-specific contributions and key research topics and development patterns.

4.1. Descriptive statistics of the combined database

The descriptive statistics presented in **Table 2** provide a summary observation of the dataset used in research, focusing on their trend, sources, document characteristics, authors and cooperation patterns.

The combined data spans from 2013 to 2025, with contribution from 12 different sources, including journals and books, consists of 13 documents in total. The dataset has experienced an annual growth rate of 15.76%, indicating frequent increase in research contribution over time. On average, the documents are relatively recent, whose average age is 2.85 years. Additionally, each document has found an average of 3.077 quotes, which suggests a moderate level of academic effects. The dataset contains 2,959 references, highlighting the comprehensive background research supporting these functions.

Regarding document contents, 85 keywords were identified using Keywords Plus (ID), while 53 keywords were provided by the authors (DE), reflecting the thematic diversity of the dataset.

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 31 Aout 2025

Table 2: Descriptive statistics of the combined database

Report	Output
MAIN INFORMATION ABOUT DATA	
Timespan	2013:2024
Sources (Journals, Books, etc)	12
Documents	13
Annual Growth Rate %	15.76
Document Average Age	2.85
Average citations per doc	3.077
References	2959
DOCUMENT CONTENTS	
Keywords Plus (ID)	85
Author's Keywords (DE)	53
AUTHORS	
Authors	30
Authors of single-authored docs	2
AUTHORS COLLABORATION	
Single-authored docs	2
Co-Authors per Doc	2.69
International co-authorships %	46.15
DOCUMENT TYPES	
article	6
book	3
book chapter	2
review	2

Source: Author's contribution

The dataset comprises 30 authors, of whom 2 have contributed single-authored documents. In terms of collaboration, 2 documents of single author, and co-authors per document is 2.69, representing a middle level of teamwork. The international co-authorship rate is 46.15%, signifying a significant proportion of cross-border academic partnerships.

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 31 Aout 2025

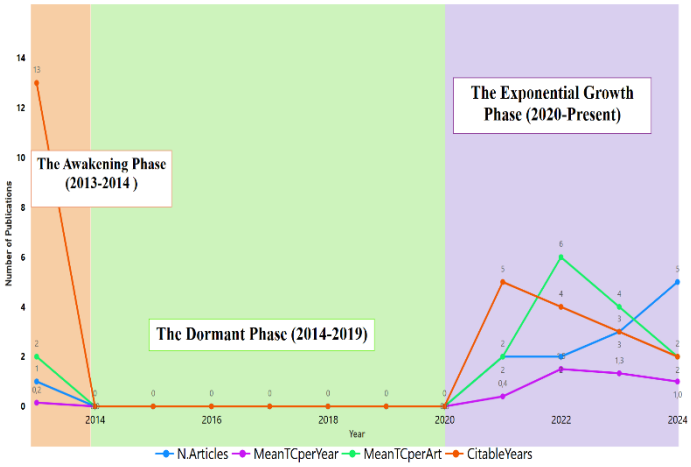
4.2. Analysis of publication trends over years

The trend evolution of research output and citation impact over the years presents an interesting pattern of three main periods.

Initial Research Phase (2013–2014): This phase represents the early emergence of research on the topic, with only one article published in 2013 and none in 2014. The limited number of publications suggests that the field was in its infancy, with researchers just beginning to explore its relevance. This period can be painted as a discovery phase, where initial efforts were made to present the subject, but without constant speed or extensive scholars' engagement.

Dormant phase (2014–2020): During this period, the research activity in the region was completely absent, as no articles were published between 2014 and 2020. Lack of publications reveals a phase of stagnation, where either the interest in the subject declined or other competitive research areas took priority. This may indicate challenges in data availability, methodical boundaries, or lack of institutional support for research in this domain. Despite the work before 2013, there was no follow-up or expansion of research, causing a gap in the contribution of scholars in the region.

Figure 2: Analysis of the trend publication[3]



Year	N,Articles	MeanTCperArt	MeanTCperYear	CitableYears
2013	1	2	0,15	13
2014	0	0	0,00	0
2015	0	0	0,00	0
2016	0	0	0,00	0
2017	0	0	0,00	0
2018	0	0	0,00	0
2019	0	0	0,00	0
2020	0	0	0,00	0
2021	2	2	0,40	5
2022	2	6	1,50	4
2023	3	4	1,33	3
2024	5	2	1,00	2

Source: Author's contribution

Growth and Expansion Phase (2020–2024): This phase marks a significant revival in research activity, began in 2021, when two articles were published, followed by a stable surge in later years. The publication's number in 2021 increased from 2 to 5 in 2024, indicating increasing interest in the subject and increasing number of contributors. The trends of the citation also

[3] CitableYears refer to the number of years, during which the articles are considered citable. N refers to the total count of articles. MeanTCperArt represents average total citations per article. MeanTCperYear indicates average total citations per year.

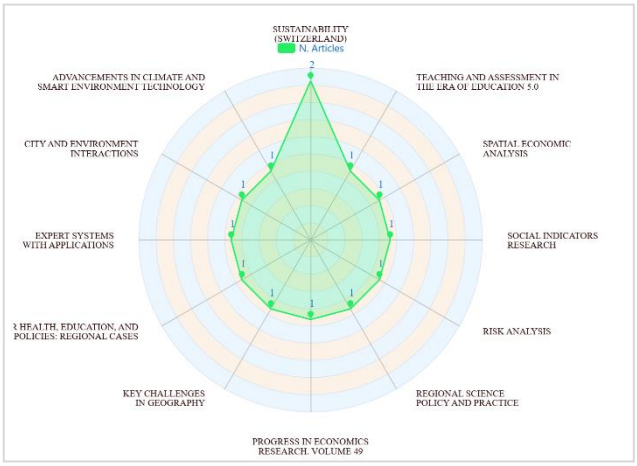
African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 31 Aout 2025

reflect this renewed engagement, with a peak in 2022 (MeanTCperArt = 6, MeanTCperYear = 1.5), followed by the decline in 2023 and 2024, which is natural because it takes time to cite newly published papers. This period reflects a revival and rapid expansion of research, suggesting that the subject has gained recognition and relevance within academic and policy-making communities. The increasing number of publications and citations throws light on the growing body of knowledge, which can continue to expand in the coming years.

4.3. Most Relevant Sources

Figure 3 provides a summary of sources in which articles related to research are published. A total of 13 articles are distributed in 12 separate sources, showing that research is multi-disciplined and including sustainability, regional science, economics, education and technology in different fields.

Figure 3: Most relevant sources



Source: Author's contribution

The "sustainability" journal is the most prominent source, which contributes 2 articles, suggests that the subject aligns well with sustainable development, environmental policies and socioeconomic implications. Other sources, such as "City and Environmental Interactions" and "Spatial Economic Analysis", emphasize spatial and regional dimensions of research, while "Risk Analysis" and "Social Indicators Research" expose concerns related to risk evaluation and social welfare. The inclusion of sources such as "Specialist Systems with Applications" and "Progress in Climate and Smart Environmental Technology" reflects the increasing integration of artificial intelligence and technological progress in addressing spatial inequality. Additionally, the presence of books like "ICTs for Health, Education, and Socioeconomic Policies: Regional Cases" and "Teaching and Assessment in the Era of Education 5.0"

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 31 Aout 2025

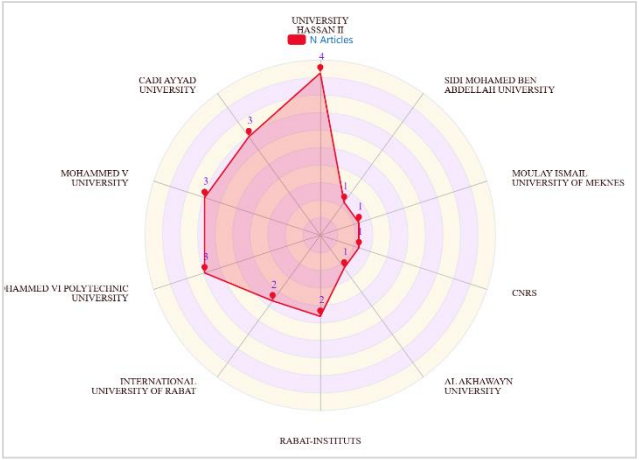
highlights the essential education's role and digital transformation in determining regional development.

4.4. Most Pertinent Affiliations

Figure 4 presents the distribution of articles by institutional affiliation, showing that all contributing institutions are based in Morocco. This suggests that this bibliometric analysis focuses on research produced within universities and research institutions of Morocco.

"University Hassan II" goes with 4 articles, making it the most active contributor in this research field. Followed by "Caddy Ayyad University, Mohammad V University, and Mohammad VI Polytechnic University" contributes 3 articles, which indicates strong connections with these institutions in topics related to spatial inequality, remote sensing and artificial intelligence.

Figure 4: Most pertinent affiliations in Morocco



Source: Author's contribution

Other institutions, such as the "International University of Rabat" and "Rabat-Institutes", each contributed 2 articles, while "Al Akhawayn University, Moulay Ismail University of Meknes, and Sidi Mohammad Ben Abdellah University" have each 1 article, which shows a more limited but still important participation. The presence of CNRS (Centre National de la Recherche Scientifique) proposes an affiliation with a special research center within Morocco.

4.6. International collaboration network in this field of research

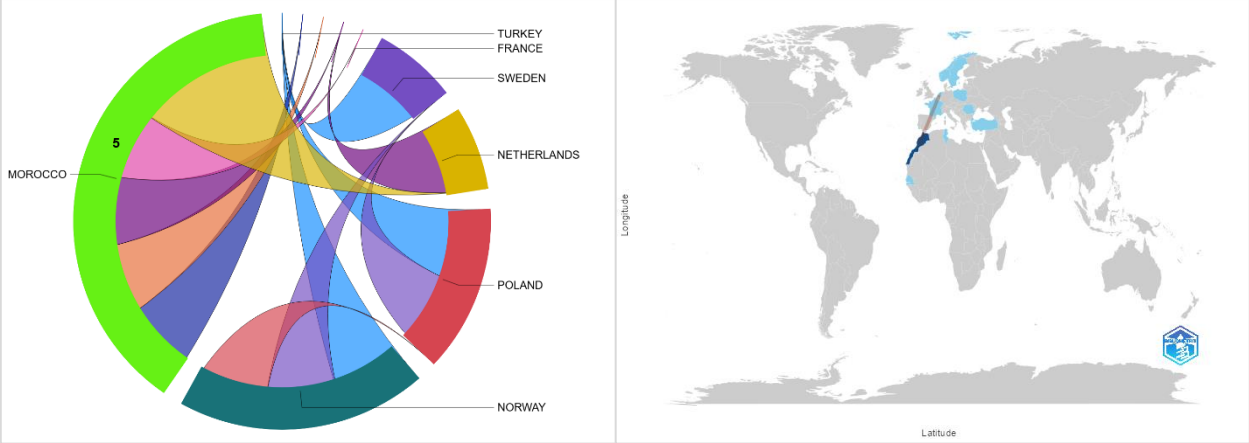
Figure 5 shows international research cooperation between Morocco and other countries, highlighting the limit of partnership in scholars' work. Data suggests that researchers from Moroccan have cooperated with France (1 Cooperation), Netherlands (2 Cooperation), Romania (1 Cooperation), Senegal (1 Cooperation), and Tunisia (1 Cooperation) colleagues.

The Netherlands manifests as the most frequent Moroccan partner with two collaborations, suggesting a relatively strong academic relationship between Moroccan institutions and Dutch

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 31 Aout 2025

researchers. Meanwhile, the partnership with France, Romania, Senegal and Tunisia indicates a diverse network spread over Europe and Africa, reflecting Morocco's relationship with both Francophone countries and comprehensive international research networks.

Figure 5: Chord diagram of Morocco collaboration with other countries



Source: Author's contribution

The presence of Senegal and Tunisia in the list emphasizes regional cooperation's within the Africa and Arab world, which may be associated with shared socio-economic and geographical research interests. Overall, these collaborations display Moroccan's growing engagement in the international educational networks, especially in Europe and Africa, spatial inequality, AI-operated forecasting and strengthening their role in global research on education.

4.7. Word Cloud of the Keywords

Figure 6 shows the word cloud generated from dataset with the main subjects of this research, the center of this research is education, which appears with the highest frequency (4 occurrences). It confirms the centrality of education as a major factor in addressing spatial inequality, strengthening its role in shaping human capital, labor market results and regional development. Related words such as "academic performance," "learning," "human capital," job markets, "and" students "highlight the importance of education in socio-economic mobility and workforce development.

The keywords such as "spatial analysis," "regional economy," "regional policy," and the presence of "socio-economic status" underlines the geographical dimension of inequality, indicating a strong link between spatial inequalities and economic outputs. These words directly connect with data analytics and satellite imagery to map and understand regional inequalities in Morocco.

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 31 Aout 2025

Figure 6: Word cloud of the keywords

Source: Author's contribution

"Machine Learning," Data Analytics, "Data Mining," Data Science, "and" Natural Language Processing "reflects the technical and AI-operated approach in this research. These keywords confirm the role of advanced computational techniques in forecasting and analysis of spatial inequality trends.

In addition, words such as "trade openness," "Commerce," "Sustainable Development," and "Innovation" suggest interest in economic policies that promote regional convergence and inclusive growth. The presence of "policy makers" confirms the applied nature of your research, which emphasizes the importance of evidence-based policy to remove spatial inequalities.

4.8. Co-occurrence Analysis of Keywords

Co- occurrence network analysis reveals different thematic clusters, each representing a concept in the research landscape.

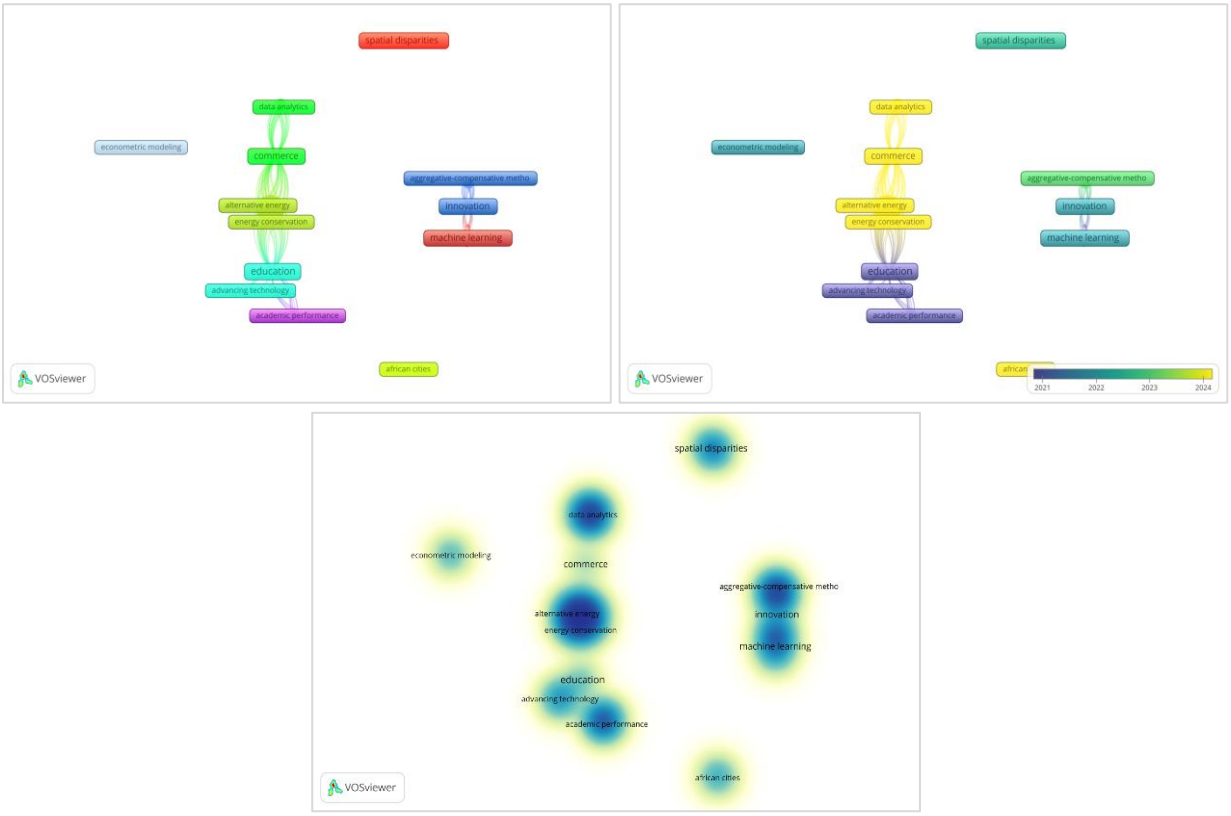
Cluster 1 shows the dynamics of the economic and labor market: it focuses on themes such as "employment," job markets, "labor markets," wages, "and" unemployment "and labor economics, workforce participation and regional economic inequalities. The inclusion of "human capital," "education," and "skill development" suggests that labor market results are greatly affected by investing in education and vocational training. The concept of "trade openness" is associated with the impact of globalization on regional employment trends, while "economic mobility" and "inequality" highlights inequalities in job access and wage distribution.

Cluster 2 shows spatial and regional inequalities: this cluster is concentrated around "spatial analysis," "regional inequalities," spatial economy, "" regional growth, "and" regional policies ". These words suggest a strong interest in the geographical dimensions of inequality and

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 31 Aout 2025

economic development. The presence of "urban flexibility," "urban challenges," and "urbanization processes" focuses on how urban expansion affects spatial inequalities. Additionally, "African city" and "suburban regions" emphasize the role of metropolitan areas in shaping economic development.

Figure 7: Co-occurrence network analysis of keywords



Source: Author's contribution

Cluster 3 show education, human development and social well-being: Education emerges as an important subject, such as "academic performance," "students," "graduate students," and words like "Learning". For comprehensive indicators of human development, these links, including "human capital," human development index (HDI), and "welfare". The presence of "health" and "health status" leads the association between education, socio-economic position and quality of life. "Social conflict" and "social deficit" suggests that inequality in education and employment can contribute to social stress.

Cluster 4 shows technological and methodological approaches: This cluster focuses on data-driven research methods, as the keywords suggest that AI and advanced statistical techniques are being used to analyze and predict spatial and economic inequalities. "Economics," "Econometric modeling," and "panel data economics" highlight the importance of strong analytical structures in these studies.

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 31 Aout 2025

Cluster 5 shows stability and energy transition: This subject includes "sustainable development," "renewable energy," alternative energy, "and" energy conservation ". These concepts show interest in how environmental policies and energy infections affect regional economic growth and inequalities. "Risk assessment" appears in this cluster, which suggests concerns about environmental weaknesses and economic risks associated with climate change.
Cluster 6 show policy and governance: The role of policy makers has been exposed through conditions like "policy makers," "regional policy" and "quantitative and GIS approach". These concepts emphasize the importance of making evidence-based decisions in addressing regional inequalities. The inclusion of "tourism demand" and "commerce" suggests that economic diversification strategies, including the development of major areas, are being discovered as policy solutions.

5. Discussion

Bibliometric analysis, combined with co-occurrence network analysis, provides a structured method to identify key research subjects and their interrelations. By examining the trends of publication, keyword relations and citation patterns, analysis shows how scholars have developed in understanding regional inequality, AI-operated analysis and understanding the mediation role of education in Morocco. The co-occurrence network highlights the strong relationship between spatial inequalities, labor market dynamics, educational access and advanced AI techniques, which emphasizes increasing dependence on geopolitical analysis to research machine learning, econometric modeling and regional inequalities. There are four major topics from these findings that need further discussion:

5.1. Regional inequality and economic development

The analysis highlights the perseverance of regional inequalities in Morocco, characterizing inequalities in employment, economic mobility and urban development. The co-concurrence network identifies strong relations between regional inequalities, the challenges of the labor market and economic policies, it suggests that spatial inequalities are formed by unequal economic opportunities in areas. Studies indicate that rural areas suffer from limited employment and weak industrial diversity perspectives, which increase socio -economic inequalities (Bun and Makhloufi, 2007). Keywords such as "regional inequalities", "space economy" and "regional development" emphasize the role of geospatial analysis in the understanding of these inequalities. In addition, the presence of "urban resilience", "urbanization processes" and "African cities" suggests that urban expansion plays an important role in regional economic reorganization, while suburban and rural areas are deprived. These

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 31 Aout 2025

findings align with previous research, which emphasize the need for location-based policies to reduce inequality and encourage inclusive regional development.

5.2. The Mediating role of education in reducing inequality

Education emerges as an important factor to reduce spatial and economic inequalities. The co-occurrence network reflects strong associations between "education," "human capital," academic performance, "" and "job needs", highlighting the role of educational attainment in labor market integration and economic mobility. Research confirms that uneven access to quality education is a major contributor to regional economic inequalities (Ibourk & Amaghouss, 2014). Bibliometric analysis further focuses on growing scholars at the intersection of education and inequality, with an increasing number of studies examining how vocational training, higher education, and lifelong learning programs impact regional development (Hoel, 2013). Additionally, words such as "graduate students," "student performance," and "skill development" strengthen the need for policy interventions that align education with regional labor market needs. Given the co-occurrence of "policy makers" and "regional policies", conclusions support calls for education reforms that are region-specific and consistent to address skills mismatched in various economic fields (Ibourk & Raoui, 2025).

5.3. AI-operated techniques for spatial inequality

AI-based techniques have promising directions in analyzing and predicting regional inequalities. The current findings, particularly a major approach used to assess the spatial inequalities which are illustrated by these connected keywords (machine learning, data analytics, spatial economy and natural language processing and natural language processing). AI- operated studies have taken advantage of techniques such as GeoAI, data mining and clustering algorithms to assess urban-rural inequalities, economic mobility and human development indices based on satellite imagery (Chang et al, 2023). GIS-based approaches, remote sensing technologies, previous studies using deep learning models in detections such as Meliho et al. (2022) is shown. In particular, the machine learning algorithm has been successfully employed to model regional inequalities, including environmental risks that affect the economically deprived areas (Elghouat et al., 2024). These conclusions confirm that AI is an essential tool in spatial economic analysis, which provides high-resolution, data-operated insights crossing traditional economic models.

5.4. Forecast of regional inequality with AI-based model

The forecast of regional inequalities is an increasing research field, which takes advantage of AI-based modeling to detect socio-economic trends. The keyword network reveals concrete

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 31 Aout 2025

relations between these issues (economic modeling, forecasting technology and spatial inequalities), suggesting the growing attention in the future analysis in inequality studies. AI -based forecast models, such as deep learning and set methods are now widely used to detect socio-economic gaps (Sahibi and Hamzaoui, 2017). In addition, AI approaches, such as Granger causality tests, and the autoregressive distributed lag model (ARDL) and spatial econometric methods still used to understand the long -term impact of policy intervention, which reflect the growing recognition of data-driven models as a new promising tool for policy planning and spatiotemporal analysis.

5.5. Policy Recommendations

According to the results of this research, the subsequent policy recommendations are projected for each key theme:

5.5.1. Addressing regional inequality

• Increase decentralized development strategies: Local authorities strengthen the regional government by empowering the local authorities with the autonomy of taking more decisions and the funds targeted to remove localized economic inequalities.

• Improvement in infrastructure in underserved areas: Invest in transport, digital connectivity and public services to promote equal regional development and facilitate economic integration.

• Support regional economic divisions: Apply regional development programs to promote comparative benefits of each region, promote industries such as agriculture, renewable energy and technology-based services to create permanent local employment opportunities.

• Encourage inclusive urbanization policies: Develop spatial planning policies that prevent urban priority and promote balanced urban-rural linkage, reducing the economic differences between large cities and marginalized areas.

5.5.2. Strengthening education as a mediator of reducing inequality

• Extend access to quality education in rural areas: To bridge the rural-urban education gap, increase investments in school infrastructure, teacher training and digital education equipment.

• Increase vocational training programs: Align vocational education and technical training with regional labor market needs, ensuring that rural and marginalized population gain industry-relevant skills for economic inclusion.

• Promote for lifelong learning and digital literacy: Apply continuous education programs and digital upskilling initiative to support the workforce adaptability, especially in areas undergoing rapid economic changes.

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 31 Aout 2025

• Increase scholarship and encouragement for higher education: Provide financial assistance and incentives for students of deprived fields to reach higher education, reduce economic obstacles for human capital development.

5.5.3. Leveraging AI-driven techniques to analyze spatial inequality

- Develop a national AI & big data strategy for regional planning: Establish a centralized data hub integrating remote sensing, geoAI, and ML/DL models to monitor and assess regional inequalities in real-time.
- Promote open access to spatial data: Encourage data-sharing initiatives between government agencies, universities, and the private sector to enhance research-driven policymaking.
- Adopt AI-powered decision-support systems: Utilize predictive analytics and AI-driven spatial modeling to optimize resource allocation, disaster preparedness, and infrastructure planning in economically disadvantaged regions.
- Invest in AI capacity building: Strengthen AI research and training programs to develop a skilled workforce capable of leveraging geospatial intelligence and data science for policy formulation.

5.5.4. Enhancing forecasting of regional inequality with AI-based models

• Apply AI-based initial warning systems: deploy machine learning models and remote sensing tools to detect economic crisis, environmental risks and initial signs of social weaknesses, allowing active policy intervention.

• Use AI for socio-economic impact assessment: To evaluate the long-term impact of regional development policies and develop AI-operated forecast models for adaptive, evidence-based decision making.

• Strengthen AI-Government Cooperation: Foster partnership between AI researchers, policy makers and urban planners to integrate advanced data analytics in Morocco's economic and spatial plan structure.

• Encourage smart cities and digital governance initiatives: Support the adoption of AI-operated smart city solutions to increase regional development, including real-time urban monitoring, future infrastructure maintenance and AI-operated transport scheme.

These policy recommendations align with Morocco's new development model (NDM) and Vision 2030, which strengthens the need for data-powered policy making, inclusive economic development and permanent regional development. By taking advantage of education, AI and

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 31 Aout 2025

Big Data Analytics, Morocco can effectively reduce spatial inequalities and promote long-term socio -economic flexibility.

6. Conclusion

This bibliometric research examines the mixing of remote sensing, Geo analysis, and AI-powered methodologies in analyzing spatial inequality in Morocco and exploring the role of education as mediator in reducing spatial inequality.

The results suggest that regional inequalities remain a persistent challenge, with a wide gap. Education has a crucial role in mitigating regional inequalities, where limited access to education in rural areas increases economic inequalities, while investing in vocational training, digital education and life learning programs can increase economic mobility and can align the development of human capital with the needs of the labor market. This research also underlines the appearance of AI techniques in the form of the equipment required to analyze spatial inequalities. Advanced machine/deep learning models, satellite imagery and geospatial intelligence provide real -time information about regional inequalities, providing data-driven tools to design specific interventions. In addition, this research emphasizes the importance AI-based models in the prediction of long -term trends in regional inequality. By integrating techniques based on AI in policy analysis and formulation, Morocco can assess socio -economic vulnerabilities, improves resources allocation and active development can implement strategies. Although this research provides an overview of the current landscape, more research is required to increase the precision of the AI model, expand the geospatial database and evaluate the long -term impact of policies promoted by AI on regional development. In addition, future studies can explore the integration of AI with traditional economic models to develop more comprehensive forecast structures for spatial inequality analysis. When using AI, big data and the flexibility of satellite images, Morocco has the opportunity to promote regional development and increase socioeconomic well -being. The results of this research contribute to the ongoing political debate on regional sustainable development, offering an innovative approach to technology to treat regional inequalities and shape a more inclusive economic future.

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 31 Aout 2025

References

1. Amaghouss, J., & Ibourk, A. (2020). Toward a spatial approach for convergence: Regional inequalities in term of multidimensional poverty in Morocco. International Journal of Development Issues, 19(2), 187-204. DOI:10.1108/IJDI-07-2019-0131
2. Bakour, C., & Abahamid, M. Y. (2019). Regional disparities in development in Morocco: Statistical analyses using dispersion indicators and multidimensional techniques. https://mpra.ub.uni-muenchen.de/97105/
3. Boutayeb, A. (2006). Social inequalities and health inequity in Morocco. International Journal for Equity in Health, 5, 1-6. DOI: 10.1186/1475-9276-5-1
4. Bun, M. J., & Makhloufi, A. E. (2007). Dynamic externalities, local industrial structure and economic development: panel data evidence for Morocco. Regional studies, 41(6), 823-837. DOI: 10.1080/00343400601142787
5. Chang, S., Abdelnour, Y. S. K., Cardoso, I. M. C., Kim, J., Kim, S. T., & Oh, J. H. (2023, December). Assessing Regional Disparities in Human Development and Multidimensional Poverty: A Satellite Imagery and Machine Learning Approach. In 2023 IEEE International Conference on Big Data (BigData) (pp. 6113-6115). IEEE. DOI:10.1109/BigData59044.2023.10386928
6. De Haas, H. (2006). Migration, Remittances and Regional Development in Southern Morocco. Geoforum, 37(4), 565-580. DOI:10.1016/j.geoforum.2005.11.007
7. De Haas, H. (2009). International migration and regional development in Morocco: A review. Journal of ethnic and migration studies, 35(10), 1571-1593. https://doi.org/10.1080/13691830903165808
8. Echchakoui, S. (2020). Why and how to merge Scopus and Web of Science during bibliometric analysis: the case of sales force literature from 1912 to 2019. Journal of Marketing Analytics, 8, 165-184. DOI: 10.1057/s41270-020-00081-9
9. El Ansari, R. (2009). Dynamique régionale et développement inégal au Maroc. In communication au colloque international Inégalités et développement dans les pays méditerranéens, Université de Galatasaray, Istanbul, Turquie (pp. 21-23). http://gdri.dreem.free.fr/wp-content/c2-3el-ansari-communication.pdf
10. El Mezouary, L., Hadri, A., Kharrou, M. H., Fakır, Y., Elfarchouni, A., Bouchaou, L., & Chehbouni, A. (2024). Contribution to advancing aquifer geometric mapping using machine learning and deep learning techniques: a case study of the AL Haouz-Mejjate

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 31 Aout 2025

aquifer, Marrakech, Morocco. Applied Water Science, 14(5), 102. https://doi.org/10.1007/s13201-024-02162-x

11. Elghouat, A., Algouti, A., Algouti, A., Baid, S., Ezzahzi, S., Kabili, S., & Agli, S. (2024). Integrated approaches for flash flood susceptibility mapping: spatial modeling and comparative analysis of statistical and machine learning models. A case study of the Rheraya watershed, Morocco. Journal of Water and Climate Change, 15(8), 3624-3646. https://doi.org/10.2166/wcc.2024.726
12. Hashem, A., El Sabry, H., & Khalil, T. (2024, October). Using Night-Time Light for Technology Diffusion Analysis. In 2024 6th Novel Intelligent and Leading Emerging Sciences Conference (NILES) (pp. 551-554). IEEE. DOI:10.1109/NILES63360.2024.10753244
13. Haut-Commissariat au plan (HCP). (2021). The New Development Model. https://www.hcp.ma/attachment/2327977/
14. Hoel, A. (2013). Maintaining Momentum on Education Reform in Morocco. World Bank. https://www.worldbank.org/en/news/feature/2013/09/11/maintaining-momentum-on-education-reform-in-morocco
15. Hofer, M., Sako, T., Martinez, A., Addawe, M., Bulan, J., Durante, R. L., & Martillan, M. (2020). Applying artificial intelligence on satellite imagery to compile granular poverty statistics (No. 629). ADB Economics Working Paper Series. http://dx.doi.org/10.2139/ssrn.3785112
16. Ibourk, A., & Amaghouss, J. (2014). Regional dynamic of educational inequality in Morocco: an empirical investigation. International Journal of Education Economics and Development, 5(3), 209-226. DOI:10.1504/IJEED.2014.065286
17. Ibourk, A., & Raoui, S. (2021). Scale effect on territorial disparities of sustainable human development in Morocco: a spatial analysis. Discover Sustainability, 2, 1-20. https://doi.org/10.1007/s43621-021-00068-1
18. Ibourk, A., & Raoui, S. (2025). Territorial obstacles causing early school dropout in Morocco: Multivariate spatial analysis. Heliyon, 11(1). https://doi.org/10.1016/j.heliyon.2024.e41386
19. Leila, B., Loubna, B., & Ali, B. (2021). Impacts of mining activities on soil properties: case studies from Morocco mine sites. Soil Science Annual, 71(4), 395-407. DOI:10.37501/soilsa/133011

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 31 Aout 2025

20. M. Aria, C. Cuccurullo, (2017). bibliometrix: an R-tool for comprehensive science mapping analysis, Journal of Informetrics 11 (4). 959–975, https://doi.org/10.1016/j.joi.2017.08.007.
21. Mathane, T. P., Gumbo, T., & Makoni, E. N. (2024, April). Spatial Justice in the Distribution of Smart City Digital Technologies: Three Area-Based Case Studies of Free Municipal Wi-Fi in the City of Tshwane, South Africa. In KEEP ON PLANNING FOR THE REAL WORLD. Climate Change calls for Nature-based Solutions and Smart Technologies. Proceedings of REAL CORP 2024, 29th International Conference on Urban Development, Regional Planning and Information Society (pp. 527-533). CORP–Competence Center of Urban and Regional Planning. DOI: 10.48494/REALCORP2024.7092
22. McGowan, M. A., & San Millán, J. A. (2019). Reducing regional disparities for inclusive growth in Spain. https://www.oecd.org/content/dam/oecd/en/publications/reports/2019/05/reducing-regional-disparities-for-inclusive-growth-in-spain_cf433139/9acff09a-en.pdf
23. Meliho, M., Khattabi, A., Driss, Z., & Orlando, C. A. (2022). Spatial prediction of flood-susceptible zones in the Ourika watershed of Morocco using machine learning algorithms. Applied Computing and Informatics. https://doi.org/10.1108/ACI-09-2021-0264
24. Mishra, A., Mishra, A., & Pandey, G. (2023). Spatial inequality and education: unraveling the geographical dimensions of educational disparities. DOI: 10.30954/2231-4105.01.2023.6
25. Mosaid, H., Barakat, A., John, K., Faouzi, E., Bustillo, V., El Garnaoui, M., & Heung, B. (2024). Improved soil carbon stock spatial prediction in a Mediterranean soil erosion site through robust machine learning techniques. Environmental monitoring and assessment, 196(2), 130. DOI: 10.1007/s10661-024-12294-x
26. N.J. van Eck, L. Waltman, (2010). Software survey: VOSviewer, a computer program fobibliometric mapping, Scientometrics 84 (2). 523–538, https://doi.org/10.1007/s11192-009-0146-3.
27. Qin, J., Yu, W., Li, S., Zhou, W., & Shen, S. (2023). Does Regional Urbanization Promote Balanced Land Development? Evidence from Long Time Series Satellite Imagery. Remote Sensing, 15(3), 783. https://doi.org/10.3390/rs15030783

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 31 Aout 2025

28. S.A.S. AlRyalat, L.W. Malkawi, S.M. Momani, Comparing bibliometric analysis using pubmed, scopus, and web of science databases, JoVE (2019), https://doi.org/10.3791/58494.
29. Sahibi, Y., & Hamzaoui, M. (2016). Spatial Inequality of Growth in Morocco Regions. Available at SSRN 2863760. http://dx.doi.org/10.2139/ssrn.2863760
30. Sahibi, Y., & Hamzaoui, M. (2017). Spatial inequality of growth between Morocco regions. DOI:10.5901/mjss.2017.v8n2p227
31. Salhi, S., Boujrouf, S., & Gourfi, A. (2023). Spatial Disparities: An Approach to Reveal "Hidden Areas" to Territorial Development in the Marrakech-Safi Region—Morocco. In Sustainable Development Goals in Europe: A Geographical Approach (pp. 195-214). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-031-21614-5_10
32. Seddouki, M., Benayad, M., Aamir, Z., Tahiri, M., Maanan, M., & Rhinane, H. (2023). Using machine learning coupled with remote sensing for forest fire susceptibility mapping. Case study tetouan province, northern Morocco. The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, 48, 333-342. https://doi.org/10.5194/isprs-archives-XLVIII-4-W6-2022-333-2023
33. Simou, M. R., Houran, N., Benayad, M., Maanan, M., Loulad, S., & Rhinane, H. (2024). Monitoring Forest Degradation Over Four Decades Using Remote Sensing and Machine Learning Classification Algorithms in Bouskoura, Morocco. The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, 48, 337-342. https://doi.org/10.5194/isprs-archives-XLVIII-4-W9-2024-337-2024
34. Stiglitz, J. E. (2012). The price of inequality: How today's divided society endangers our future. WW Norton & Company.
35. Sun, Y., Qin, T., Zhang, J., Yang, K., & Zhu, X. (2024). Measurement of higher education competitiveness level and regional disparities in china from the perspective of sustainable development. Economics, 18(1), 20220122. https://doi.org/10.1515/econ-2022-0122
36. Wassima, M., Hamida, S., Akouz, N., Saleh, S., Cherradi, B., & Raihani, A. (2024). Predictive Modeling of Flood Susceptibility in Tetouan, Morocco Using Machine Learning Algorithms. In 2024 4th International Conference on Innovative Research in Applied Science, Engineering and Technology (IRASET) (pp. 1-7). IEEE. https://revues.imist.ma/index.php/AJMET/article/view/51613

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 31 Aout 2025

37. Xu, H., Yang, H., Li, X., Jin, H., & Li, D. (2015). Multi-scale measurement of regional inequality in Mainland China during 2005–2010 using DMSP/OLS night light imagery and population density grid data. Sustainability, 7(10), 13469-13499. https://doi.org/10.3390/su71013469
38. Yang, Z., Zhang, L., Liu, C., Chen, Y., Wu, R., & Zheng, Y. (2024). Evaluation of economic inequality in 'the Belt and Road'region–The application of night-time satellite imagery. The World Economy, 47(7), 3076-3096. https://doi.org/10.1111/twec.13567
39. Yeh, C., Perez, A., Driscoll, A., Azzari, G., Tang, Z., Lobell, D., ... & Burke, M. (2020). Using publicly available satellite imagery and deep learning to understand economic well-being in Africa. Nature communications, 11(1), 2583. https://doi.org/10.1038/s41467-020-16185-w
40. Zreik, M. (2024). The Belt and Road Initiative and Morocco: Opportunities and Challenges for Strengthening Economic Relations with China. Moroccan Institute for Policy Analysis. https://mipa.institute/en/11007