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Diretor José Cadima Ribeiro

Co-Editores Conceição Rego e João Marques

APDR
ASSOCIAÇÃO PORTUGUESA PARA O DESENVOLVIMENTO REGIONAL

RSAI
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Assessing the Impacts of Urbanisation on Land Use Changes and Avian Fauna in Wetlands of Tamil Nadu, India

Evaluación de los Impactos de la Urbanización en los Cambios de Uso del Suelo y la Fauna Aviar en los Humedales de Tamil Nadu, India

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Abstract

Wetlands are vital ecosystems that sustain diverse biodiversity, offering crucial resources like water, food, and habitats for numerous species. However, rapid urbanization and associated human activities have led to significant wetland degradation and loss, particularly in Tamil Nadu, India. Their integration aids in maintaining the food chain and ecological balance. However, rapid urbanization and human activities are causing significant degradation and loss of wetland areas. This study uniquely integrates decade-long satellite-based LULC and NDVI analyses with migratory bird census data to reveal how urbanization, pollution, and land use changes have directly degraded the Karaivetti Bird Sanctuary's wetland habitat and caused a sharp decline in bird populations. By precisely linking environmental changes to biodiversity loss, it provides novel, data-driven insights and practical conservation recommendations, offering a valuable model for wetland management and biodiversity protection in rapidly developing regions. The study employed Land Use Land

Cover (LULC) analysis and satellite imagery to monitor changes in wetlands from 2013 to 2023. The findings of the present research indicated substantial reductions in vegetation cover and water quality due to industrial discharges, sewage, and agricultural runoff. These alterations have negatively impacted habitats, resulting in a decrease in migratory bird visits and overall biodiversity. Wetlands provide invaluable ecological services and support rich biodiversity. The degradation of these ecosystems due to anthropogenic activities threatens the species that rely on them. The present research recommends the minimization of fishing activities during migratory seasons, establishing silent zones to reduce disturbances, and enforcing stringent measures against illegal dumping of construction debris. Henceforth, implementation of these measures aids in mitigating the adverse impacts on wetlands and promotes the sustainability of these essential ecosystems.

Keywords: Wetlands, LULC, Karaivetti, Vegetation cover, Migratory bird, Anthropogenic, Ecosystem

JEL code: R0 General, Q0 General

Resumen

Los humedales son ecosistemas vitales que sustentan una biodiversidad diversa y ofrecen recursos cruciales como agua, alimentos y hábitats para numerosas especies. Su integración ayuda a mantener la cadena alimentaria y el equilibrio ecológico. Sin embargo, la rápida urbanización y las actividades humanas están causando una degradación y pérdida significativa de áreas de humedales. Esto es particularmente evidente en la disminución de las poblaciones de aves en santuarios como Karaivetti, atribuida a los escombros de la construcción, el aumento de los asentamientos humanos y las perturbaciones del tráfico vehicular y las actividades pesqueras. El estudio empleó el análisis de la cobertura del suelo y el uso del suelo (LULC) e imágenes satelitales para monitorear los cambios en los humedales de 2013 a 2023. Los hallazgos de la presente investigación indicaron reducciones sustanciales en la cobertura vegetal y la calidad del agua debido a los vertidos industriales, las aguas residuales y la escorrentía agrícola. Estas alteraciones han afectado negativamente a los hábitats, lo que ha dado como resultado una disminución de las visitas de aves migratorias y de la biodiversidad en general. Los humedales brindan servicios ecológicos invaluables y sustentan una rica biodiversidad. La degradación de estos ecosistemas debido a actividades antropogénicas amenaza a las especies que dependen de ellos. Se requieren acciones inmediatas para lograr estrategias de gestión y conservación efectivas para proteger y restaurar los hábitats de humedales. La presente investigación recomienda minimizar las actividades pesqueras durante las temporadas migratorias, establecer zonas silenciosas para reducir las perturbaciones y aplicar medidas estrictas contra el vertido ilegal de escombros de construcción. De ahora en adelante, la implementación de estas medidas ayuda a mitigar los impactos adversos sobre los humedales y promueve la sostenibilidad de estos ecosistemas esenciales.

Palabras clave: Humedales, LULC, Karaivetti, Cobertura vegetal, Aves migratorias, Antropogénico, Ecosistema

Código JEL: R0 General, Q0 General

1. INTRODUCTION

Freshwater wetlands cover more than 8% of the Earth's land surface (Dayathilake et al., 2021) and are recognized as keystone ecosystems due to their disproportionate impact on landscape processes relative to their area (PA, 2009). These wetlands offer a wide array of ecosystem services, including flood control, water purification, carbon sequestration (Lu & Xiao, 2024), and support for a diverse range of plants and animals (Balwan & Kour, 2021). Their ecological functions are crucial for regulating the ecological balance and maintaining biodiversity, as they provide essential habitat, food, shelter, and water for numerous species (Jisha & Puthur, 2021; Rijal et al., 2021). High biodiversity within freshwater wetlands enhances the stability of these functions, supporting nutrient cycling and resilience against external disturbances (Nayak & Bhushan, 2022).

Despite their immense value, wetlands are experiencing significant decline (Dayathilake et al., 2021). Globally, as much as 87% of wetlands have been lost over the past 300 years, with much of this loss occurring since 1900, primarily due to changes in climate and land use, including urbanization and infrastructural development (Davidson, 2014). In the United States, wetland area depreciation is largely attributed to these factors (Davidson, 2014). The ecological consequences of these changes can be measured using specialized tools, which help generate long-term, large-scale, and comprehensive assessments of wetland health and function (Demarquet et al., 2023; Salimi et al., 2021).

Bird migration is closely tied to the seasonal availability of food resources in wetlands, with birds making round trips between nesting and resting areas (Barik et al., 2022; Bathrick et al., 2024; Smetzer et al., 2021). Migratory birds positively influence ecosystem health (Faaborg et al., 2010; Schmaljohann et al., 2022), but their populations are rapidly declining due to habitat loss, reduction in food sources, and loss of nesting sites often linked to urban expansion and modern architecture (Seress & Liker, 2015; Yong et al., 2021). Changes in land use and land cover driven by infrastructural development reduce available habitats, impacting bird nesting and feeding grounds (Bhatta, 2023; James Reynolds et al., 2019; Xu et al., 2018). This habitat loss leads to fewer bird visitations and population declines, forcing birds to adapt to new migratory locations, which introduces additional threats (Dawson-Scully, 2024; Radić & Gavrilovic, 2021).

The Karaivetti Bird Sanctuary exemplifies these challenges. Known for its rich diversity of ducks, waders, swimmers, divers, migrants, and endangered species, the sanctuary has recently seen a decline in migratory bird numbers due to land area changes caused by Public Works Department operations (Baranidharan et al., 2024; Satheesh et al., 2024). These modifications disrupt the delicate ecosystem balance, resulting in habitat degradation that adversely affects avian populations (Gokula, 2013).

The Karaivetti Bird Sanctuary is a 4.537 sq. km protected area. It is located at Karaivetti village in the Ariyalur District of Tamil Nadu, South India (Pradeepkumar et al., 2015). It was established on April 5, 1999. Additionally, it is one of Tamil Nadu's biggest freshwater lakes, located in the south (Salahudeen et al., 2013). It is known to be the habitat for at least 188 species of birds. International recognition comes from Karaivetti Wildlife Sanctuary. Karaivetti, which benefits from water derived from the Kaveri River and rainwater through the Pullambadi-Kattalai canal, lies approximately 50 km northeast of Tiruchchirappalli town. Also, it is the district's largest water body and receives half a million bird visitors annually. The government of Tamil Nadu declared it as a bird sanctuary in 1999 because it holds importance as a habitat for a large variety of birds. The lake has the capacity to hold water up to an average depth of three meters when it is full. A total of 188 species of birds has been found to inhabit the sanctuary, of which 82 are water birds. For water birds on migration, the sanctuary is one of the most important freshwater feeding sites.

The study aims to investigate the causes of this decline with the following objectives:

- To measure land use and land cover (LULC) changes in the Karaivetti wetland region between 2013 and 2023 based on satellite images and remote sensing methods.
- To determine trends in migratory and resident bird populations in the Karaivetti Bird Sanctuary between the same years based on census data.
- To examine the interconnection between LULC change, vegetation cover (NDVI), and avian population dynamics.
- To assess the influence of factors associated with urbanisation (e.g., pollution, development, human disturbance) on the quality of wetland habitat and avian diversity.
- To offer pragmatic conservation measures oriented towards compensating for the negative impacts of urbanisation and enhancing the sustainability of wetland ecosystems and associated avian fauna.

On the basis of the above discussion, the present research has formulated the following research questions:

1. What is the demographic status of the migrating bird populace in Karaivetti Bird Sanctuary?
2. What patterns have arisen in the populations of migratory birds over the past decade in the bird sanctuary?
3. What are the broader implications of the transformation of land use and cover on the avian populace in Tamil Nadu?
4. How does the variation in vegetation influence the habitat preference of migratory birds?

The research hypotheses are as follows:

Rapid urbanisation and associated land use changes in and around the Karaivetti Bird Sanctuary have led to significant degradation of wetland habitats, resulting in a measurable decline in avian diversity and migratory bird populations over the past decade.

The significance of the research lies in the crucial examination of the impact of land use changes and urbanization on wetlands. It focuses on the avian populace in India. The factors contributing to the decline of bird populations are essential for the conservation of biodiversity and monitoring of ecological health (Fraixedas et al., 2020). Thereafter, the study intends to suggest the targeted conservation measures that counteract the negative effects on the habitats that are beneficial to both the local people and wildlife dependent on the wetland resources. In examining the particular reasons for the reduction of the avian population, the study research intends to provide actionable information that can inform effective management practices. The current study seeks to heighten awareness towards the importance of wetlands among local communities, policymakers, and conservationists. It encourages the decision-making process that reconciles urban landscape development with ecological integrity.

Therefore, this study seeks to comprehend why bird populations are decreasing and to develop protective measures to lessen the effects of environmental and infrastructure changes.

The rest of the paper is organized as follows: The second section describes the research design with detailed descriptions of methods for LULC classification, NDVI analysis, and bird census data collection. The third section communicates the findings related to land use changes, vegetation cover changes, and the avian population trends for the study period. The fourth section interprets these results with reference to the literature, revealing the intricate interactions between urbanization, wetland degradation, and biodiversity loss. Section 5 talks about the study limitations and the potential practical and theoretical implications of the findings. The article ends with a declaration section and thorough references that back up the research framework and the authors' interpretations.

2. MATERIALS AND METHODS

2.1 Research design

The LULC pattern and land use and cover pattern for the periods 2013, 2016, 2018, 2020, and 2023 were evaluated using satellite data from Landsat 8-9 Operational Land Imager (OLI) and Thermal Infrared (TIRS). Then the datasets of Landsat MSS, TM, and OLI (USGS Earth Explorer) were used to examine the LULC (Islam et al., 2021). Satellite images showing vegetation coverage in the designated wetlands across various years were gathered from Google Earth Pro. The study area is the Karaivetti Bird Sanctuary (10°59’N, 79°14’E), located in Karaivetti village, Ariyalur District, Tamil Nadu, India, covering 4.537 km². All satellite images were selected for the post-monsoon season (December–February) to minimize seasonal variation.

2.2 Land use and land cover classification (LULC)

The land use pattern was categorized into dense vegetation, wetlands, buildings, less vegetation, and dry land (Table 1) (Sarkar & Maji, 2022). The supervised Maximum-likelihood classifier technique was utilized for the identification of LULC changes throughout the study period. ERDAS Imagine software was utilized for image processing of Landsat TM images. Multi-temporal Landsat satellite data were utilized for LULC changes assessment. The NDVI is a dominant remote sensing method used to illustrate the vegetation features in a region (Jin et al., 2024; Rouse Jr et al., 1973; Tucker et al., 1985). The ratio of the difference between spectral bands responsive to the spectral features gives a single value that is the index (1). By adding the initial value of NDVI, a multiplication by 10,000, and their rounding, numbers were converted into an integer scale of 0–20,000 for deleting the wrong numbers and thus transforming them into unsigned integers up to the hundredths place accurately. These transformed units of NDVI are applied during the computation as well as in the output of the original model of regression.

The transformed NDVI units will be represented as NDVIT.

$$NDVI = (Band4 - Band5)/(Band4 + Band5) \qquad \text{Eq. (S1)}$$

The precision of the classified images was estimated with ground truth data. Measures were user's accuracy (Eq. S2), producer's accuracy (Eq. S3), overall accuracy (Eq. S4), and kappa coefficient (Eq. S5). The adjustments in the image analysis according to the precision were conducted as outlined in the schematic representation (Figure 1).

For each year, a minimum of 50 training polygons per class were selected using field GPS points and high-resolution Google Earth imagery. Validation was performed with at least 200 random points (40 per class) per classified map, cross-checked with field data and high-resolution imagery.

$$Users\ Accuracy = \frac{(Number\ of\ correctly\ classified\ pixels\ in\ each\ category)}{Total\ number\ of\ classified\ pixels\ in\ that\ category} * 100$$

Eq. (S2)

In the user accuracy, the total number of classified pixels is the summation of the rows.

$$Producer\ Accuracy = \frac{(Number\ of\ correctly\ classified\ pixels\ in\ each\ category)}{Total\ number\ of\ reference\ pixels\ in\ that\ category} * 100$$

Eq. (S3)

In producer accuracy, the total number of reference pixels refers to the summation of columns.

$$Overall\ Accuracy = \frac{(Total\ number\ of\ correctly\ classified\ pixels\ )}{Total\ number\ of\ reference\ pixels} * 100$$

Eq. (S4)

In overall accuracy, the diagonal values are added for the total number of correctly classified pixels.

$$Kappa\ coefficient\ (T) = \frac{((TS \times TCS) - \sum[(Column\ total \times Row\ total)])}{(TS^2 - \sum[(Column\ total\ \times Row\ total)])} \times 100$$

Eq. (S5)

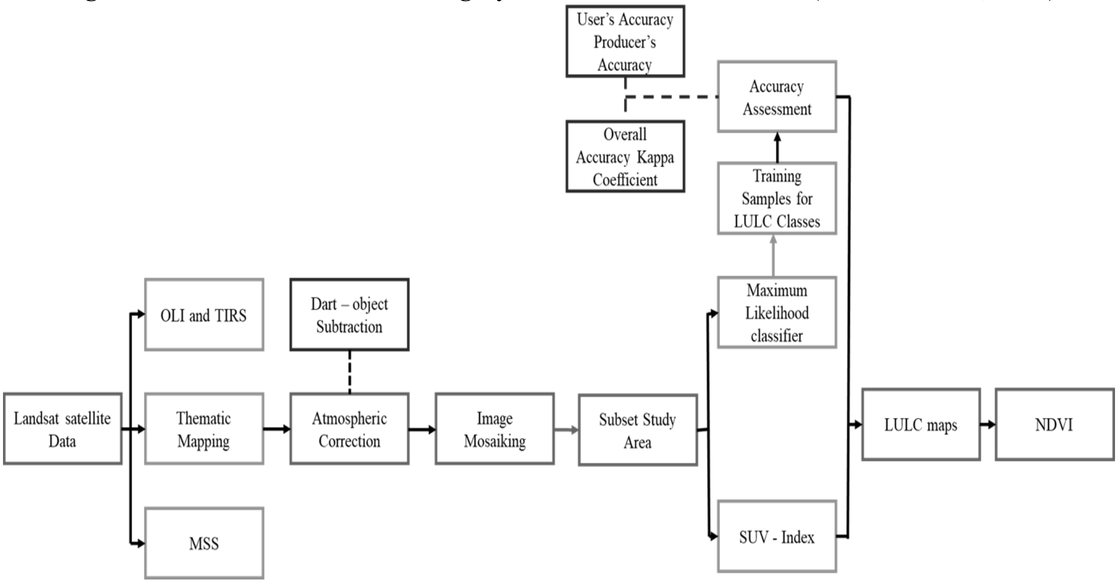
Table 1. Classification Scheme (Camilleri et al., 2017; Deb & Nathr, 2012).

ID	Land use/land cover	Description
1	Dense vegetation	The areas with natural vegetation cover in the form of herbs, shrubs, grassland, trees, and other plants.
2	Wetlands	It comprises all forms of surface water present in drains, canals, ponds, lakes, and wetlands.
3	Less	It consists of cultivated and non-cultivated areas.
4	Dry land	It contains the land left with no vegetation and harsh terrain with poor moisture.
5	Buildings	Areas of constructed land.

2.3 Bird census

Bird surveys were undertaken during the Northeast monsoon (October-December) and winter months (January-February) of 2023. Counts were done during morning hours (6:00 to 10:00 AM GMT+5:30) so that there was no two-fold counting. Point counts were done by counting all birds observed by sight and hearing from a fixed point for a particular duration. Bird tally at 6 observation points with binoculars and cameras. Species identification and foraging habitat were noted on the Asian Water Bird Census (AWC) form. Aquatic birds were counted during morning and evening sessions at 6 locations, each for 15 minutes. Forest Survey of wetland migratory birds' data was used for interpretation and cross-verification.

Figure 1 Flow chart of satellite imagery to obtain the NDVI index (Essaadia et al., 2022)



Each of the 6 observation points was georeferenced using GPS (coordinates provided in Supplementary Table 1). A minimum of three trained observers participated in each survey session. Sample sizes per survey ranged from 1,615 to 10,943 individual birds, depending on the year. Historical census data from 2013, 2016, 2018, and 2020 were also included for trend analysis.

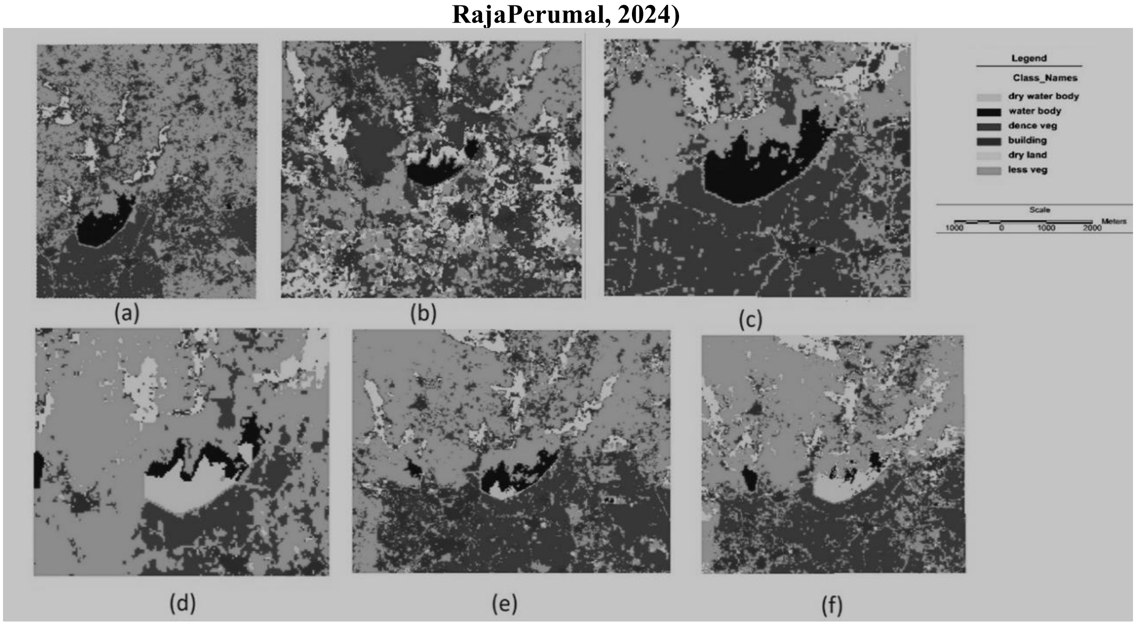
3. RESULTS

The LULC change has been observed in wetlands from 2013 to 2023. Each wetland region has been categorized into five LULC classes: building, wetland, dense vegetation, less vegetation, and dry land.

3.1 Classification accuracy assessment

Accuracy analysis is very important in image classification for the verification of LULC. Many pixels are still wrongly classified in MLS because the data is not evenly distributed. Accuracy assessment was carried out by summarizing and quantifying the data through the use of an error matrix. The accuracy results were obtained, including producer accuracy, user accuracy, overall accuracy, and the kappa coefficient index. It is being tested m overall accuracy to come up with the accurate result for the classification accuracy. Therefore, the overall for accuracy was determined for satellite images of Karaivetti Lake in 2013, 2016, 2018, 2020, 2021, and 2023 and is reported as 85%, 85%, 90%, 95.83%, 91.6%, and 87.5%, respectively, with kappa statistics of 75%, 86.36%, 87.5%, 95%, 89.91%, and 85%, respectively.

Figure 2 Vegetation, water body, density, dry lands and building at Karaivetti bird sanctuary and nearby area in 2013 (a), 2016 (b), 2018 (c), 2020 (d), 2021 (e) and 2023 (f) (Sivasubramaniyan & RajaPerumal, 2024)

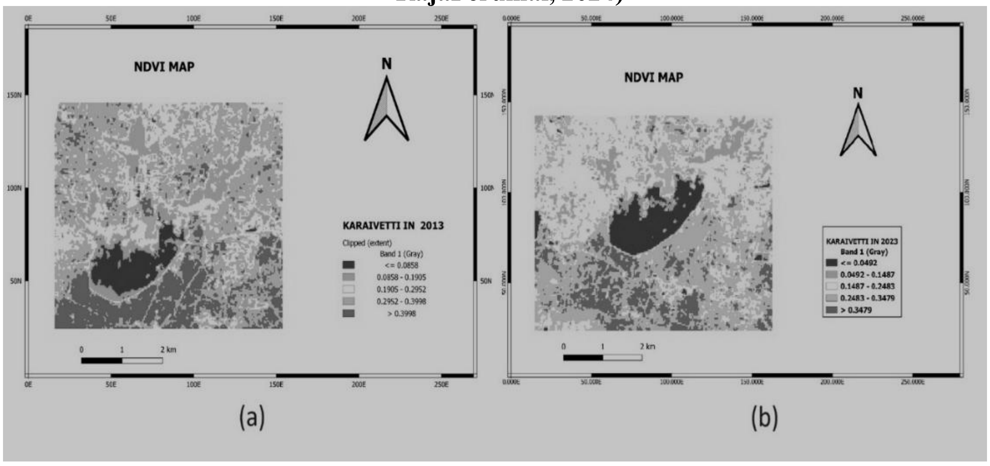


The overall evaluation outcomes of each classified image from 2013 to 2023 for the vegetation, water body, density, dry lands, and building at Karaivetti Bird Sanctuary are shown in Figure 2. The LULC maps clearly demonstrate a marked reduction in wetland and dense vegetation areas between 2013 and 2023. Built-up areas and dry land have expanded, particularly along the sanctuary's boundary and near access roads. For instance, the northwestern and southeastern edges show the most pronounced urban encroachment. This spatial pattern highlights the direct impact of urban expansion on natural habitats and supports the quantitative findings of wetland and vegetation loss. The visual progression across the years provides compelling evidence of habitat fragmentation and landscape transformation.

3.2 Normalised differential vegetation index

The result of the NDVI assessment communicated that the wetlands were exposed to significant alterations in the vegetation indices that affect their ecosystem and habitat. NDVI values of research areas indicate unstable water availability. In addition, the presence of water raises them, but their superiority starts to decline because of the industrial effluents, release of sewage water, and construction waste. It severely affects the vegetation cover. The NDVI maps (Figure 3) and time-series plots reveal a consistent decline in overall vegetation health from 2013 to 2023. Average NDVI values dropped from approximately 0.65 in 2013 to 0.38 in 2023, indicating a substantial reduction in healthy green vegetation. Areas with NDVI below 0.2, representing degraded or barren zones, have increased, especially in the southern and central wetland regions. This trend is closely associated with increased anthropogenic disturbance, such as construction, effluent discharge, and agricultural runoff. The correlation between NDVI decline and LULC change underscores the loss of productive habitat for avian fauna.

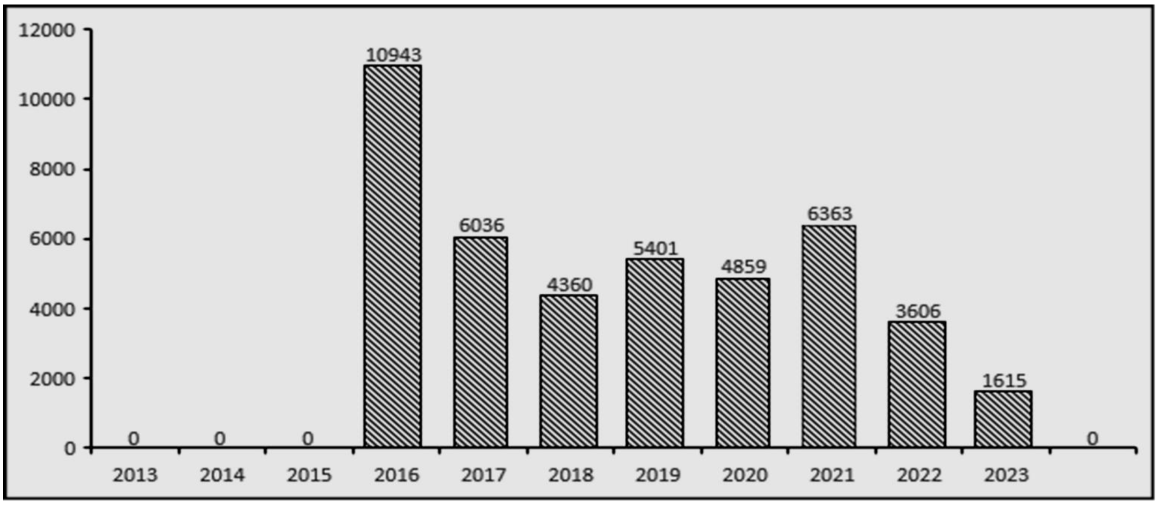
Figure 3 NDVI Map of Karaivetti Bird Sanctuary in 2013 (a) and 2023 (b) (Sivasubramaniyan & RajaPerumal, 2024)



3.3 Avian fauna population

The number of migrating birds in the Karaivetti bird sanctuary has reduced in comparison to prior years, and some of the species are not being visited. In 2016, there were 10,943 birds recorded, and in 2023, the number was just 1,615. The glossy ibis' black-winged stilt population is drastically declining. Greenshank, Bar-headed Goose, Spoonbill, and a few other birds have not been observed. The total number of migratory birds visiting the bird sanctuary is shown in Figure 4.

Figure 4 Total number of Migratory Birds observed in the year of 2013-2023 (Gokula, 2013; Shree & Malathi, 2024)



The research location has been recorded as having intensive use of farmlands and the excessive discharge of industrial and sewer waste. Land use and land cover were manifested through processed satellite images of the research site. These classificatory pictures refine the awareness regarding the LULC pattern for the study location. The study shows that the unregulated and ongoing process of land use pattern expansion occurs here. The data obtained revealed that there was a rapid contamination of the wetlands as well as excessive use of synthetic chemicals in agricultural processes that might hurt the environment and affect public health.

Availability of water and the natural vegetation cover on the ground influence the expansion of new areas of agriculture and the rate at which birds visit. However, the decline in water availability and unplanned agricultural practices can affect the aesthetic value of the natural environment and contribute to desertification and soil degradation, thereby reducing biodiversity and bird migration.

There are rising and falling trends in the overall variation in each variable's occurrence in wetland areas. The classified images of the whole study area indicate a significant change that implies a concealed decrease over the last ten years for all the investigated classes: wetland, dense vegetation, sparse vegetation, buildings, and dry land. The spatial overlap between areas of greatest LULC change and key bird habitats highlights the direct ecological consequences of land transformation. The data strongly suggest that anthropogenic activities are the primary driver of these negative trends.

Similarly, the connection between vegetation and temperature was examined through NDVI data from 2013 to 2023. The resulting LULC maps showed a reduction in vegetation during the examined timeframe. This notable reduction in plant life is linked to the over-release of industrial, municipal, and agricultural substances, which also impacts the accessibility of plant habitats near the wetland. The periods before and after the monsoon are typically when there is an increased availability of water. The region under investigation is, in several respects, facing similar environmental issues that have ravaged the wetland's natural allure.

The research argues that the inflow of wastewater from domestic, commercial, and saline seepage into the wetlands was the primary reason for the decreased water quality. The study implies that the key causes of the drop in water quality were attributed to the release of effluents from industrial, domestic, agricultural, and saline discharges into the wetlands. The findings gathered indicated that this vital resource has disappeared due to poor management and human activities that have significantly affected the natural biodiversity habitat, leading to a reduction in migratory bird visits. The PWD development on the plant cover and arid lands around the water body has resulted in a reduction in natural vegetation cover within the lake boundaries. This leads to the modification of natural wetlands, resulting in vegetation losing the necessary habitat and environment for bird populations.

4. DISCUSSION

Wetlands are essential in ensuring ecological stability and hosting diversity in wildlife, as emphasized by (Dayathilake et al., 2021) and (Lu & Xiao, 2024). The current research illustrates the immense reduction in wetland cover and bird population at Karaivetti Bird Sanctuary during the last decade, a pattern that is congruent with global and regional studies of wetland depletion (Davidson, 2014). The declining wetland and dense vegetation cover, coupled with expanding built-up and dry land, mirrors the trends of land use change documented for other fast-growing urbanizing areas in South Asia (Islam et al., 2021). Spatial analysis registers the worst encroachment along the periphery of the sanctuary, especially in the northwestern and southeastern areas. This is in agreement with Bhatta (2023), who opined that peripheral urban expansion is one of the main causes of habitat fragmentation of Indian wetlands. The reduction of average NDVI values between 2013 and 2023, as was found in this research, is reflective of decreased vegetation quality and concurs with (Barik, Saha, & Mazumdar, 2022), who attributed NDVI reduction to pollution, development, and agricultural runoff in Indian wetlands.

A steep decline in Karaivetti migratory birds from 10,943 in 2016 to 1,615 in 2023 is a reflection of the worldwide trend in declining wetland-dependent bird species (Fraixedas et al., 2020). The incorporation of LULC and NDVI trends into the study and avian census data furnish unequivocal proof of land use change influencing bird populations. Habitat specialist and migratory birds, like the glossy ibis and bar-headed goose, have shown the most severe declines, while generalist species remain present. This makes sense with the findings of Dawson-Scully (2024) and (Seress & Liker, 2015), who highlighted the susceptibility of habitat specialists to habitat destruction driven by urbanization.

Whereas (Barik, Saha, & Mazumdar, 2022) discovered that habitat heterogeneity is able to cushion some of the effects of land use change, the Karaivetti data indicate that the magnitude and extent of urban encroachment have surpassed the ability of habitat heterogeneity to sustain avian diversity. The concurrent loss of vegetation cover and water quality decline due to industrial and agricultural effluents has lowered the availability and quality of feeding and nesting sites, in agreement with Gokula (2013) and (Satheesh, Baranidharan, Krishnamoorthi, Vijayabhama, & Mugilan, 2024).

Moreover, certain local stressors like illicit dumping of construction waste, intensified fishing activity during the migration periods, and vehicular disturbance have been found to play a prominent role in habitat degradation. These observations concur with (Gokula, 2013), who pinned down uncontrolled human activities as driving wetland degradation in South India.

The findings indicate that site-specific management interventions may be efficient. Policies like banning fishing during migration seasons, providing silent zones, and having anti-dumping laws are feasible and can be easily implemented. Such a method aligns with the pragmatic conservation suggestions discussed by (Sarkar & Maji, 2022). By integrating multi-temporal remote sensing (NDVI and LULC) and field-based bird census data, this research enhances the causal association between land use alteration and biodiversity decline. This interdisciplinary approach improves over past descriptive research by adding quantitative, spatially-explicit proof of ecosystem degradation (Demarquet et al., 2023; Salimi et al., 2021).

5. CONCLUSION

The primary purpose of this research was to find out how urbanization influenced land use changes and bird fauna within the Karaivetti Bird Sanctuary. A 10-year study involving satellite-based LULC, NDVI data, and bird population censuses helped us to comprehend the environmental degradation and its direct impact on biodiversity. Our research hypothesis is supported by the findings as it is shown that rapid urbanization together with associated anthropogenic activities has resulted in wetland habitat degradation to an extent that can be measured and a decline in avian diversity has occurred. The major changes illustrate that the wetland area and dense vegetation cover have been significantly reduced, the built-up and dry land have been simultaneously increased, and the decline of vegetation health, as shown by NDVI values, has been very obvious. The changes in the environment have led directly to a substantial decrease in the migratory bird population by 85% between 2016 and 2023, and several species have stopped visiting the sanctuary entirely. Among the factors causing these effects are industrial effluents, sewage discharge, agricultural runoff, illegal dumping of construction debris, and increased human disturbance from traffic and fishing activities. This decline in the bird population has far-reaching effects that not only threaten the sanctuaries but also put the regional ecological stability and biodiversity at risk. To counterbalance these detrimental effects and maintain the vitality of this tightly-knit ecosystem, we suggest the introduction of focused conservation measures such as the reduction of fishing activities during the migratory seasons, the creation of silent zones for disturbance abatement, and the enforcement of strict measures against illegal dumping. This research is an essential, data-driven example of the necessity of careful wetland management in areas undergoing rapid urbanization. It clearly points out that there is an urgent need to strike a balance between urban development and ecological preservation if we want to conserve these priceless ecosystems for the future.

5.1 Practical implications

There is an immediate requirement for specific conservation tactics, such as creating quiet areas during migration periods and enforcing stricter rules against unlawful dumping. These actions can significantly reduce the negative effects on wetland environments and aid in the recovery of biodiversity. Decision-makers have the ability to utilize the data from this research to create long-term land-use policies that integrate wetland preservation, such that these vital environments are protected against urban growth. Engaging with local communities is also essential; by instilling a sense of ownership and responsibility towards wetland conservation, stakeholders can enhance the success of such efforts. Additionally, public awareness-raising campaigns can educate communities regarding the importance of wetlands and the consequences of their degradation and encourage sustainable ways that benefit the environment and regional economies.

5.2 Theoretical implications

The current research serves to create a link between ecosystem service degradation and the loss of biodiversity, highlighting the need for healthy wetlands in ensuring ecological balance and facilitating different species. This study further adds to current knowledge regarding urbanisation influence on natural ecosystems through the provision of empirical data that can be used to inform future studies into similar trends within other regions. The findings recommend a multidisciplinary strategy in the study of wetland health by bringing together ecological, sociological, and economic perspectives to develop more comprehensive models. Lastly, the research underscores the necessity for long-term studies in order to understand better the current changes in wetland ecosystems over a period of time, stressing the significance of considering the long-term impacts of conservation activities and urbanization on wetland health and diversity.

5.3 Limitations

The present research study only covers a short time frame from 2013 to 2023, which may not capture long-term ecological patterns. Additionally, the focus is mainly on specific wetland areas like Karaivetti, which could restrict the applicability of the results to other regions facing different environmental challenges. In addition, though the study focuses on migratory bird populations, it fails to provide a complete analysis of other species residing in these wetlands and may miss general biodiversity shifts. Assessing human activities influencing wetlands is complex because there are local practice variations and socioeconomic determinants not extensively investigated. Although the analysis is restricted, the study provides useful data regarding wetland degradation and its influence on biodiversity.

REFERENCES

Balwan, W. K., & Kour, S. (2021). Wetland-an ecological boon for the environment. *East African Scholars Journal of Agriculture and Life Sciences*, *4*(3), 38-48.

Baranidharan, K., Krishnamoorthi, S., Vijayabhama, M., & Mugilan, S. (2024). Status, Diversity and Species Composition of Wetland Birds on Vaduvoor Bird Sanctuary, Tiruvarur District, Tamil Nadu, India. *Journal of Agriculture and Ecology Research International*, *25*(3), 99-106.

Barik, S., Saha, G. K., & Mazumdar, S. (2022). Influence of land cover features on avian community and potential conservation priority areas for biodiversity at a Ramsar site in India. *Ecological Processes*, *11*(1), 25.

Bathrick, R. E., Johnson, J. A., Ruthrauff, D. R., Snyder, R., Stager, M., & Senner, N. R. (2024). Migratory strategies across an ecological barrier: is the answer blowing in the wind? *Movement Ecology*, *12*(1), 70.

Bhatta, V. R. (2023). Bird diversity in cities and impact of urbanization on avifauna. *Birds around us: science and emotion*, 25-37.

Camilleri, S., De Giglio, M., Stecchi, F., & Pérez-Hurtado, A. (2017). Land use and land cover change analysis in predominantly man-made coastal wetlands: towards a methodological framework. *Wetlands Ecology and Management*, *25*, 23-43.

Davidson, N. C. (2014). How much wetland has the world lost? Long-term and recent trends in global wetland area. *Marine and Freshwater Research*, *65*(10), 934-941.

Dawson-Scully, L. (2024). Effects of Urbanization on Community Composition and Conditions of Birds in Wetland Ecosystems. *UF Journal of Undergraduate Research*, *26*.

Dayathilake, D., Lokupitiya, E., & Wijeratne, V. (2021). Estimation of soil carbon stocks of urban freshwater wetlands in the Colombo Ramsar Wetland City and their potential role in climate change mitigation. *Wetlands*, *41*(2), 29.

Deb, S. K., & Nathr, R. K. (2012). Land use/cover classification-An introduction review and comparison. *Global Journal of researches in engineering Civil And Structural engineering*, *12*(1), 5-16.

Demarquet, Q., Rapinel, S., Dufour, S., & Hubert-Moy, L. (2023). Long-term wetland monitoring using the landsat archive: A review. *Remote Sensing*, *15*(3), 820.

Essaadia, A., Abdellah, A., Ahmed, A., Abdelouahed, F., & Kamal, E. (2022). The normalized difference vegetation index (NDVI) of the Zat valley, Marrakech: comparison and dynamics. *Heliyon*, *8*(12).

Faaborg, J., Holmes, R. T., Anders, A. D., Bildstein, K. L., Dugger, K. M., Gauthreaux Jr, S. A., Heglund, P., Hobson, K. A., Jahn, A. E., & Johnson, D. H. (2010). Recent advances in understanding migration systems of New World land birds. *Ecological monographs*, *80*(1), 3-48.

Fraixedas, S., Lindén, A., Piha, M., Cabeza, M., Gregory, R., & Lehikoinen, A. (2020). A state-of-the-art review on birds as indicators of biodiversity: Advances, challenges, and future directions. *Ecological Indicators*, *118*, 106728.

Gokula, V. (2013). Avifauna of Karaivetti Bird Sanctuary, Tamil Nadu, India. *ZOO'S PRINT*, *28*(6), 23-29.

Islam, H., Abbasi, H., Karam, A., Chughtai, A. H., & Ahmed Jiskani, M. (2021). Geospatial analysis of wetlands based on land use/land cover dynamics using remote sensing and GIS in Sindh, Pakistan. *Science Progress*, *104*(2), 00368504211026143.

James Reynolds, S., Ibáñez-Álamo, J. D., Sumasgutner, P., & Mainwaring, M. C. (2019). Urbanisation and nest building in birds: a review of threats and opportunities. *Journal of Ornithology*, *160*(3), 841-860.

Jin, X., Fan, Y., Hu, Y., Duan, H., Yan, L., & Liu, C. (2024). Differences in the Effects of Three Water Elements on Vegetation in Different Climatic Regions: Insights From the Yellow River Basin, China. *Ecohydrology*, e2733.

Jisha, K., & Puthur, J. T. (2021). Ecological importance of wetland systems. *Wetlands conservation: current challenges and future strategies*, 40-54.

Lu, M., & Xiao, Z. (2024). Wetland ecology and climate change: Addressing global challenges with countermeasures. *Advances in Resources Research*, *4*(1), 67-88.

Nayak, A., & Bhushan, B. (2022). Wetland ecosystems and their relevance to the environment: importance of wetlands. In *Handbook of research on monitoring and evaluating the ecological health of wetlands* (pp. 1-16). IGI Global.

PA, K. (2009). Wet and wonderful: the world's largest wetlands are conservation priorities. *Bioscience*, *59*, 39-51.

Pradeepkumar, R., Sisubalan, N., Basha, M. H. G., & khan Anwardeen, I. (2015). Floristic and Medicinal plant survey at Karaivetti Bird Sanctuary, tamil Nadu, India. *Spatula DD□ Peer Reviewed□ ournal on Complementary Medicine and Drug Discovery*, *5*(1), 27.

Radić, B., & Gavrilovic, S. (2021). Natural habitat loss: Causes and implications of structural and functional changes. *Life on Land*, 699-712.

Rijal, S., Rauniyar, A., Thapa, S., Paudel, U., & Gautam, D. (2021). ECOSYSTEM SERVICES OF WETLANDS AND THREATS IN CONTEXT OF NEPAL. *International Journal of Forest, Soil and Erosion*, *11*(2), 1-6.

Rouse Jr, J. W., Haas, R. H., Schell, J., & Deering, D. (1973). *Monitoring the vernal advancement and retrogradation (green wave effect) of natural vegetation*.

Salahudeen, M., Saranya, E., Gunasekaran, C., & Vadivalagan, C. (2013). Studies on the abundance and distribution of birds in three different habitats of Karur District, South India. *Journal of Entomology and Zoology Studies*, *1*(3), 57-63.

Salimi, S., Almuktar, S. A., & Scholz, M. (2021). Impact of climate change on wetland ecosystems: A critical review of experimental wetlands. *Journal of Environmental Management*, *286*, 112160.

Sarkar, D., & Maji, N. (2022). Status and threats of wetland change in land use pattern and planning: impact of land use patterns and urbanization. In *Handbook of Research on Monitoring and Evaluating the Ecological Health of Wetlands* (pp. 106-127). IGI Global.

Satheesh, N., Baranidharan, K., Krishnamoorthi, S., Vijayabhama, M., & Mugilan, S. (2024). Diversity of Avian Fauna in Karaivetti Bird Sanctuary, Ariyalur District, Tamil Nadu, India. *Annual Research & Review in Biology*, *39*(6), 71-86.

Schmaljohann, H., Eikenaar, C., & Sapir, N. (2022). Understanding the ecological and evolutionary function of stopover in migrating birds. *Biological Reviews*, *97*(4), 1231-1252.

Seress, G., & Liker, A. (2015). Habitat urbanization and its effects on birds. *Acta Zoologica Academiae Scientiarum Hungaricae*, *61*(4), 373-408.

Shree, N. R., & Malathi, E. (2024). A checklist of avifauna from different microhabitats in Muttukadu backwaters, Tamilnadu, India. *Journal of Asia-Pacific Biodiversity*, *17*(1), 169-178.

Sivasubramaniyan, T., & RajaPerumal, R. N. (2024). Original Research Article Identifying land use land cover dynamics using machine learning method and GIS approach in Karaivetti, Tamil Nadu. *Journal of Autonomous Intelligence*, *7*(3).

Smetzer, J. R., Paxton, K. L., & Paxton, E. H. (2021). Individual and seasonal variation in the movement behavior of two tropical nectarivorous birds. *Movement Ecology*, *9*, 1-15.

Tucker, C. J., Townshend, J. R., & Goff, T. E. (1985). African land-cover classification using satellite data. *Science*, *227*(4685), 369-375.

Xu, X., Xie, Y., Qi, K., Luo, Z., & Wang, X. (2018). Detecting the response of bird communities and biodiversity to habitat loss and fragmentation due to urbanization. *Science of the Total Environment*, *624*, 1561-1576.

Yong, D. L., Heim, W., Chowdhury, S. U., Choi, C.-Y., Ktitorov, P., Kulikova, O., Kondratyev, A., Round, P. D., Allen, D., & Trainor, C. R. (2021). The state of migratory landbirds in the East Asian Flyway: Distributions, threats, and conservation needs. *Frontiers in Ecology and Evolution*, *9*, 613172.

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A Abordagem LEADER em Portugal: Evolução, Desafios e Perspetivas de Governança Territorial Integrada

The LEADER Approach in Portugal: Evolution, Challenges, and Perspectives for Integrated Territorial Governance

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Resumo

A abordagem LEADER, lançada pela União Europeia nos anos 1990, afirmou-se como instrumento inovador para o desenvolvimento de territórios rurais desfavorecidos. Em Portugal, promoveu a criação dos Grupos de Ação Local (GAL), que reúnem parcerias entre atores públicos e privados para implementar estratégias integradas e adaptadas às especificidades locais. Este estudo analisa a evolução da abordagem no país, destacando os contributos para a coesão territorial, dinamismo económico e valorização do capital social rural. A metodologia combina análise documental e entrevistas a catorze atores-chave. Os resultados revelam progressos na capacitação local, mas também constrangimentos crescentes associados à centralização e burocratização, sobretudo após a integração no Programa de Desenvolvimento Rural e no modelo Desenvolvimento Local de Base Comunitária. Evidenciam-se tensões entre padronização nacional e necessidades locais, assim como o enfraquecimento do papel dos GAL. Defende-se um modelo plurifundos, com gestão unificada e critérios ajustados ao território, como via para revitalizar a eficácia e inovação do LEADER.

Palavras-chave: Desenvolvimento rural, Abordagem LEADER, Governança territorial, Coesão territorial, Territórios do interior, Políticas públicas

Códigos JEL: P25, Q01, Q19, R53

Abstract

The LEADER approach, launched by the European Union in the 1990s, has established itself as an innovative instrument for the development of disadvantaged rural areas. In Portugal, it promoted the creation of Local Action Groups (LAGs), bringing together partnerships between public and private actors to implement integrated strategies adapted to local specificities. This study analyses the evolution of the approach in the country, highlighting its contributions to territorial cohesion, economic dynamism, and the enhancement of rural social capital. The methodology combines documentary analysis and interviews with fourteen key actors. The results show progress in local capacity building, but also growing constraints linked to centralization and bureaucratization, particularly after integration into the Rural Development Program and the Community-Led Local Development model. Tensions emerge between national standardization and local needs, as well as a weakening of the role of LAGs. A multi-fund model with unified management and territorially adjusted criteria is advocated as a way to revitalize the effectiveness and innovation of the LEADER approach.

Keywords: Rural development, LEADER approach, Territorial governance, Territorial cohesion, Interior territories, Public policies

JEL Codes: P25, Q01, Q19, R53

1. INTRODUÇÃO

A governança e a coesão territorial constituem pilares fundamentais da política da União Europeia (UE), refletindo o compromisso em atenuar as disparidades económicas, sociais e territoriais entre as suas regiões (Ferrão & Lopes, 2004). Neste contexto, o princípio da "coesão económica, social e territorial" tem orientado as políticas de desenvolvimento regional, com o propósito de promover uma distribuição mais equitativa dos recursos, assegurando simultaneamente uma participação ativa das comunidades locais nos processos decisórios (Bosworth et al., 2015; Bosworth et al., 2020; Ledezma, 2023).

Neste quadro, a abordagem LEADER (*Liaison entre Activités de Développement de l'Économie Rurale*), criada pela UE na década de 1990, emergiu como um instrumento estratégico para fomentar o desenvolvimento integrado e endógeno nas zonas rurais, particularmente nas regiões periféricas e menos favorecidas (Corte-Real et al., 2025). Inicialmente centrada na melhoria da qualidade de vida e na diversificação económica rural, a abordagem LEADER tem vindo a evoluir em consonância com os novos desafios sociais, económicos e ambientais, articulando-se com os princípios da coesão territorial e da governança multinível promovidos pela UE (EU, 2025).

Em Portugal, a coesão territorial assume uma importância acrescida, dada a persistência de profundas assimetrias regionais. O interior do país, em particular, enfrenta fenómenos estruturais como o despovoamento, o envelhecimento demográfico e a escassez de oportunidades socioeconómicas, exigindo políticas públicas adaptadas. Embora a abordagem LEADER tenha sido amplamente adotada em diversos Estados-Membros, registando diferentes graus de sucesso e adaptação (ex: maior foco na inovação social na Finlândia ou maior integração plurifundos na Áustria), a sua implementação em Portugal demonstra particular relevância na revitalização das zonas rurais portuguesas, promovendo a diversificação das atividades económicas e contribuindo para a melhoria da qualidade de vida das populações em territórios afastados dos centros urbanos (Tribunal Contas Europeu, 2022; EU, 2023, 2025; Corte-Real et al., 2025). A especificidade portuguesa reside, em grande parte, na sua luta persistente contra as assimetrias litoral-interior, o que confere ao LEADER um papel único no reequilíbrio territorial.

Este estudo analisa a evolução da abordagem LEADER em Portugal, identificando os seus principais contributos para o desenvolvimento rural e as transformações no seu modelo de governação ao longo dos diferentes períodos de programação europeia. Através de uma abordagem qualitativa, procura-se compreender as perceções dos principais intervenientes sobre os impactos da descentralização, da integração em programas mais amplos e da crescente burocratização, refletindo sobre os desafios atuais e as perspetivas futuras para a consolidação de um modelo de desenvolvimento territorial mais integrado, participativo e eficaz.

2. A EVOLUÇÃO DAS POLÍTICAS EM PORTUGAL E NA EUROPA NO CONTEXTO DO DESENVOLVIMENTO RURAL

A evolução das políticas de desenvolvimento rural em Portugal e na UE mostra uma crescente integração entre agricultura, território e dimensão social, adaptando-se gradualmente às exigências de um desenvolvimento mais sustentável e coeso. Esta evolução foi fortemente influenciada pelos fundos europeus, pelas prioridades estratégicas da UE e pela necessidade de conciliar competitividade, coesão territorial e sustentabilidade ambiental.

2.1. Política agrícola comum e desenvolvimento rural

Desde a sua criação em 1962, a Política Agrícola Comum (PAC) assumiu um papel central na integração europeia, inicialmente focada na estabilidade dos preços agrícolas e na garantia de rendimentos para os agricultores. A criação dos Fundos de Desenvolvimento Rural (1972) e do Fundo Europeu de Desenvolvimento Regional (FEDER) (1975) ampliou o foco europeu para a redução das disparidades territoriais e modernização das regiões menos desenvolvidas (FAO, 2008).

Com a adesão de países como Portugal, Espanha e Grécia nos anos 1980, as assimetrias económicas e sociais entre Estados-membros acentuaram-se, reforçando o papel das políticas de coesão e de desenvolvimento rural como instrumentos de integração (FAO, 2008).

As reformas da PAC a partir de 1992 marcam uma viragem estrutural:

- Reforma MacSharry (1992): Reduziu os preços garantidos, introduziu pagamentos diretos compensatórios e medidas agroambientais, abrindo caminho para uma maior sustentabilidade e diversificação da agricultura (Lowe et al., 2002; Matthews, 2013; CE, 2025; CUE, 2025);
- Agenda 2000 (1999): Instituiu o segundo pilar da PAC, consagrado ao desenvolvimento rural, com cofinanciamento nacional e enfoque em modernização agrícola, ambiente e revitalização rural (Dax & Hovorka, 2007);
- Reforma Fischler (2003): Introduziu o desligamento (*decoupling*) dos apoios da produção, aplicou a condicionalidade ambiental (*cross-compliance*) e reforçou a multifuncionalidade da agricultura (CE, 2025; CUE, 2025);
- "Health Check" (2008): Ajustou os instrumentos da PAC à liberalização dos mercados, às alterações climáticas, à bioenergia e à proteção dos recursos naturais (DG AGRI, 2009);
- Reforma de 2013 (pós-2013): Enfatizou o "*greening*", através de práticas agrícolas benéficas para o ambiente e o clima, e reforçou a ligação com os Objetivos de Desenvolvimento Sustentável (Matthews, 2013);
- Nova PAC (2021/2023–2027): Atribui maior subsidiariedade aos Estados-membros, que definem Planos Estratégicos da PAC (PEPAC). No caso português, o PEPAC 2023–2027 promove a transição ecológica e digital, reforça a resiliência setorial e apoia a renovação geracional, alinhando-se com o Pacto Ecológico Europeu, a Estratégia "Do Prado ao Prato" e a Agenda 2030 (OECD, 2020; Viegas et al., 2023; EC, 2025a).

Em Portugal, a adesão à UE em 1986 foi decisiva para a modernização do setor agrícola, para a melhoria das infraestruturas rurais e para a transformação do espaço rural (Pereira & Martinho, 2017). No entanto, persistem desafios estruturais significativos, incluindo a desertificação do interior, o envelhecimento da população agrícola, a fraca renovação geracional e os impactos das alterações climáticas (Estevam & Santos, 2018; EC, 2025b). O programa LEADER, iniciado nos anos 1990, tornou-se um exemplo paradigmático, promovendo o desenvolvimento rural integrado, baseado na criação de Grupos de Ação Local (GAL) e na mobilização dos recursos locais, promovendo governança ascendente (FAO, 2008; Ray, 2000). A evolução do programa em Portugal e na UE pode ser sintetizada no Quadro 1, que destaca as principais fases, o número aproximado de GAL, o volume de financiamento mobilizado e as mudanças institucionais mais relevantes ao longo do tempo.

Quadro 1. Quadro resumido da evolução da abordagem LEADER em Portugal e na UE, indicando fases principais, número de GAL, financiamento mobilizado e alterações institucionais ao longo do tempo

Período	Fase/Programa	GAL em Portugal	Financiamento Mobilizado na UE	Principais mudanças institucionais e características
1991–1993	LEADER I	~50	1,1 mil milhões de euros	Início da abordagem LEADER com foco em zonas rurais desfavorecidas; Implementação de projetos piloto.
1994–1999	LEADER II	~70	1,8 mil milhões de euros	Expansão da metodologia LEADER; Reforço da participação local e descentralização.
2000–2006	LEADER+	~100	2,1 mil milhões de euros	Consolidação da abordagem LEADER; Integração com políticas de coesão regional.
2007–2013	PRODER (Programa de Desenvolvimento Rural)	~100	3,5 mil milhões de euros	Implementação do LEADER como medida do PRODER; Foco em desenvolvimento rural integrado.
2014–2020	DLBC (Desenvolvimento Local de Base Comunitária)	~200	9,2 mil milhões de euros	Integração do LEADER em múltiplos fundos da UE (FEADER, FEAMP, FEDER, FSE); Reforço da abordagem participativa e local.
2021–2027	PEPAC	~200	Dados em atualização	Continuação da abordagem DLBC com foco em sustentabilidade e inovação; Implementação de novas estratégias de desenvolvimento local.

Fonte: Adaptado de Tribunal Contas Europeu (2022) e Corte-Real et al. (2025)

2.2. Política de coesão territorial na UE

A Política de Coesão da UE, consolidada nos anos 1980, evoluiu de um enfoque na redução das disparidades regionais para uma abordagem mais integrada, que articula dimensões económicas, sociais e territoriais. O Tratado de Lisboa (2007) (EU, 2007) formalizou esta transformação ao consagrar o conceito de coesão territorial como objetivo central da UE, reconhecendo a importância de políticas multiescalares, multissetoriais e orientadas para a equidade territorial (Faludi, 2006; EC, 2025c).

Os Fundos Europeus Estruturais e de Investimento (FEEI) – nomeadamente o FEDER, o Fundo Social Europeu Mais (FSE+) e o Fundo de Coesão – constituem os principais instrumentos financeiros desta política. Estes fundos financiam iniciativas orientadas para a inovação, a transição digital e climática, a valorização de competências e a resiliência socioeconómica, sendo centrais na operacionalização das prioridades do Pacto Ecológico Europeu e da Agenda 2030 (CEDRU, 2022; EC, 2022).

Em Portugal, desde os anos 1990, estes fundos têm contribuído para a modernização de infraestruturas, a qualificação dos sistemas de ensino e a promoção da competitividade regional (Medeiros, 2013). Apesar desses progressos, persistem fortes assimetrias territoriais, em particular entre os centros urbanos do litoral, como as Áreas Metropolitanas de Lisboa e do Porto, e o interior do país, caracterizado por maior fragilidade económica e demográfica (Medeiros, 2018; Vilares & Moreira, 2021).

Para enfrentar esses desafios, a Agenda Territorial 2023 e o Programa Nacional de Ordenamento do Território (PNOPT) estabelecem cinco prioridades estratégicas:

- Gestão sustentável dos recursos naturais;
- Promoção de um sistema urbano policêntrico;
- Inclusão social e valorização da diversidade territorial;
- Reforço da conectividade interna e externa;
- Fortalecimento da governança territorial.

Esta última dimensão – governança territorial – tem ganho especial relevância, por ser determinante para a implementação eficaz das opções estratégicas e para a coordenação entre diferentes níveis de administração pública e atores locais.

No atual ciclo de programação (2021–2027) – Portugal 2030 –, Portugal beneficiará de mais de 23 mil milhões de euros no âmbito da Política de Coesão da UE, com enfoque na competitividade regional, sustentabilidade ambiental, coesão social e integração digital (EC, 2022; https://portugal2030.pt/).

A Agenda Territorial 2030, recentemente adotada a nível europeu, reforça essa orientação ao definir cinco objetivos estruturantes para o desenvolvimento espacial da UE: gestão sustentável dos recursos, policentrismo urbano, melhoria da conectividade, valorização da diversidade territorial e governação colaborativa (TerritorialAgenda, 2022). Estes princípios orientadores apontam para a necessidade de um modelo de desenvolvimento mais equilibrado, resiliente e inclusivo, capaz de responder aos desafios contemporâneos com soluções territorialmente adaptadas.

A convergência entre a Agenda Territorial 2030, adotada a nível europeu, e os eixos estratégicos do Portugal 2030 evidencia um alinhamento crescente entre as prioridades nacionais e os princípios orientadores da política territorial europeia. Ambas as agendas partilham uma visão integrada do desenvolvimento, que combina sustentabilidade ambiental, inclusão social, competitividade regional e reforço da governança territorial. A tabela comparativa seguinte (Quadro 2) permite visualizar estas correspondências, evidenciando como Portugal tem procurado adaptar as diretrizes europeias às especificidades do seu território.

Quadro 2. Comparação dos objetivos da Agenda Territorial 2030 com as prioridades do Portugal 2030, destacando a alinhamento estratégico para um desenvolvimento territorial sustentável e equilibrado

Objetivos da Agenda Territorial 2030	Eixos de Atuação do Portugal 2030	Correspondência Estratégica
Gestão sustentável dos recursos naturais	- Transição climática e sustentabilidade ambiental - Valorização do capital natural	Sustentabilidade ecológica e resiliência territorial
Promoção de um sistema urbano policêntrico	- Coesão territorial e competitividade das regiões - Reforço das redes urbanas de média dimensão	Redução das assimetrias litoral–interior
Inclusão social e valorização da diversidade territorial	- Inclusão social e combate às desigualdades - Promoção da coesão social e territorial	Equidade territorial e justiça social
Reforço da conectividade interna e externa	- Transição digital e acessibilidade - Investimento em infraestruturas e redes de transporte	Conectividade física e digital
Fortalecimento da governança territorial (colaborativa)	- Governança multinível e participação dos atores locais - Pactos territoriais e descentralização	Coordenação e implementação eficaz das políticas públicas

Fonte: Elaboração própria

2.3 Integração entre políticas agrícolas e de coesão em Portugal

Em Portugal, a articulação entre a PAC e a Política de Coesão tem sido reforçada através de quadros estratégicos como o Portugal 2020 e o Portugal 2030, com o objetivo de promover uma aplicação territorializada dos fundos europeus e alinhar metas agrícolas, sociais e ambientais.

O Portugal 2020 (https://portugal2020.pt/) marcou um avanço na convergência entre o Fundo Europeu Agrícola de Desenvolvimento Rural (FEADER) e o FEDER, apoiando projetos integrados em áreas como turismo rural, bioeconomia e revitalização de aldeias (Figura 1) (Medeiros, 2020). Esta abordagem incentivou a diversificação económica em territórios de baixa densidade e valorizou recursos locais. No entanto, a fragmentação institucional e a burocracia dificultaram a coordenação entre fundos e limitaram a eficácia da ação territorial (CEDRU, 2022). Estas limitações enfraqueceram o princípio da subsidiariedade e o protagonismo das entidades locais.

Com o Portugal 2030 (https://portugal2030.pt/) introduziram-se os Pactos para o Desenvolvimento e Coesão Territorial, que reforçam o papel das Comunidades Intermunicipais (CIM) na coordenação sub-regional, promovendo maior coerência entre fundos e objetivos territoriais (Figura 1).

Figura 1. Representação esquemática da evolução dos instrumentos de política territorial entre os quadros estratégicos Portugal 2020 e Portugal 2030

Fonte: Elaboração própria

Persistem, contudo, desafios como a desertificação do interior, o envelhecimento populacional e a baixa densidade económica, que exigem políticas combinadas: apoio a jovens agricultores, financiamento a Pequenas e Médias Empresas (PMEs) rurais, qualificação de serviços públicos e melhoria da conectividade (OECD, 2020; CEDRU, 2022).

Além da Coesão, a PAC articula-se também com:

- Política Ambiental: Diretivas Aves e Habitats, Rede Natura 2000 e programas LIFE;
- Política Climática e Energética: Pacto Ecológico Europeu, "Fit for 55" e metas de neutralidade carbónica;
- Política de Investigação e Inovação: Programas Horizonte 2020 e Horizonte Europa, que financiam investigação agrícola, bioeconomia e digitalização rural;
- Estratégias de Crescimento da UE: Estratégia de Lisboa e Estratégia Europa 2020, que introduziram a inovação e competitividade como prioridades.

Estas articulações mostram que o desenvolvimento rural deve ser entendido numa lógica transversal, em que a agricultura interage com ambiente, clima, inovação, inclusão social e coesão territorial (Dax & Copus, 2016; EC, 2018).

Assim, a integração entre PAC e Coesão deve ir além da gestão técnica, assumindo uma visão estratégica territorial, sustentada numa governação descentralizada e participativa, capaz de impulsionar um desenvolvimento rural sustentável.

2.4 Tendências europeias recentes: sustentabilidade, flexibilidade e participação

As políticas europeias mais recentes evidenciam uma convergência entre sustentabilidade ambiental, coesão territorial e inclusão social. A vinculação explícita das estratégias de desenvolvimento rural aos Objetivos de Desenvolvimento Sustentável (ODS) e ao Pacto Ecológico Europeu implica uma reorientação profunda das políticas públicas, exigindo uma transição ecológica que seja simultaneamente justa, inclusiva e territorialmente sensível (Cotella, 2020; Schuh et al., 2020). Neste contexto, os debates em curso no seio da UE salientam a necessidade de tornar os instrumentos de financiamento mais flexíveis, interoperáveis e coerentes com outras políticas estruturais, como o Quadro Financeiro Plurianual (QFP), a Política de Coesão, e os programas Horizonte Europa e LIFE (Ahlmeyer & Volgmann, 2023).

A Associação Europeia LEADER para o Desenvolvimento Rural (ELARD) tem sido uma das principais defensoras da integração das políticas de desenvolvimento rural no conjunto estratégico da UE. Defende uma abordagem transversal ao território, que evite a segmentação por fundos ou setores, promovendo uma visão integrada, baseada na subsidiariedade e na valorização dos recursos locais. Nesse sentido, propõe que os GAL possam aceder a diferentes instrumentos financeiros da UE, sem comprometer a sua autonomia nem o caráter ascendente das decisões (ELARD, 2025). A ELARD critica a fragmentação atual das políticas rurais e destaca o programa LEADER como um instrumento com capacidade de transformação, capaz de dinamizar as economias locais, valorizar os recursos endógenos e implementar estratégias adaptadas às especificidades de cada território.

Defende, ainda, uma maior articulação entre o LEADER/Desenvolvimento Local de Base Comunitária (DLBC) e outras políticas europeias, como forma de promover um desenvolvimento territorial mais sustentável e coerente (ELARD, 2025).

Neste alinhamento, Monteiro (2019) defende a necessidade de transitar para um modelo de governação mais participativo e territorializado, que reconheça a capacidade de agência das comunidades locais. O autor sublinha que o sucesso de iniciativas como o Programa Nacional para a Coesão Territorial (PNCT) depende da criação de quadros de governação colaborativos, que favoreçam a construção de consensos interinstitucionais e a participação ativa dos atores locais nos processos de decisão (Monteiro, 2019).

Em última análise, a tendência europeia aponta para a construção de um modelo holístico de desenvolvimento territorial, centrado nas potencialidades, especificidades e aspirações das comunidades locais, com mecanismos de governação flexíveis, multiescalares e orientados para o impacto.

Em suma, as políticas europeias de desenvolvimento rural têm evoluído no sentido de uma maior articulação entre sustentabilidade ambiental, coesão territorial e participação cidadã. Este movimento reflete uma tentativa de resposta integrada aos desafios colocados pelas mudanças climáticas, pelas desigualdades territoriais e pela necessidade de reforçar a capacidade de ação das comunidades locais. O Quadro 3 sintetiza as principais tendências observadas neste novo ciclo político, destacando os eixos estratégicos que orientam a construção de um modelo de desenvolvimento mais sustentável, flexível e participado no espaço rural europeu.

Quadro 3. Principais tendências das políticas europeias de desenvolvimento rural

Tendência central	**Elementos principais**	**Referências**
Sustentabilidade Integrada	- Alinhamento com os ODS e o Pacto Ecológico Europeu - Transição ecológica justa e inclusiva	Schuh et al. (2020) Cotella (2020)
Flexibilização dos Instrumentos	- Maior flexibilidade, interoperabilidade e coerência entre financiamentos (QFP, Coesão, Horizonte, LIFE)	UE (vários documentos estratégicos)
Integração Territorial	- Visão integrada e transversal do desenvolvimento rural - Evitar segmentações por fundos/setores - Acesso dos GAL a múltiplos fundos com autonomia e decisão ascendente - Programa LEADER/DLBC como motor de transformação local	ELARD (2025)
Participação e Governança Local	- Modelos colaborativos e participativos de governação - Fortalecimento da agência local - Exemplo: PNCT requer quadros interinstitucionais e diálogo multilateral	Monteiro (2019)
Modelo Holístico e Multiescalar	- Desenvolvimento centrado nas potencialidades locais - Mecanismos de governação flexíveis, adaptados ao território e orientados para impacto	Síntese geral

Fonte: Elaboração própria

3. METODOLOGIA

Este estudo seguiu uma abordagem qualitativa para analisar a evolução da abordagem LEADER em Portugal, com ênfase na sua implementação, nos impactos territoriais e nos desafios de governança. A metodologia combinou dois pilares: (i) recolha e análise documental e (ii) entrevistas semiestruturadas com atores-chave.

3.1. Recolha e análise documental

A primeira etapa consistiu na recolha e análise documental da literatura científica e institucional, com o objetivo de mapear os principais contributos teóricos e empíricos sobre a abordagem LEADER, a governança territorial e as políticas de desenvolvimento rural em Portugal e na UE Os tópicos de pesquisa foram definidos com base em estudos prévios que destacam estas dimensões como centrais para a compreensão do desenvolvimento rural participativo e da operacionalização de políticas locais.

A pesquisa recorreu a três bases de dados académicas: Scopus, Web of Science e RCAAP. Foram inicialmente obtidos 20 documentos na Scopus, 22 na Web of Science e 9 no RCAAP. Após a aplicação de critérios de inclusão (estudos publicados nos últimos 20 anos, em português ou inglês, focados nos tópicos de interesse) e exclusão (duplicados, artigos sem acesso ao texto completo ou fora do escopo), a amostra final selecionada consistiu em 29 documentos, que foram analisados de forma detalhada.

Foram utilizadas combinações booleanas de palavras-chave como "Abordagem LEADER" e “governança”, "Desenvolvimento Local Liderado pela Comunidade" e “Desenvolvimento Rural”, "Governança Territorial" e “Descentralização”, "Desenvolvimento Participatório" e “Política Rural da UE”.

Esta abordagem permitiu identificar lacunas analíticas, afinar as dimensões de análise que orientaram a construção do guião de entrevistas e fornecer uma base documental sólida para a investigação. Limitações decorrentes da seleção de tópicos, bases de dados e palavras-chave foram consideradas na interpretação dos resultados, garantindo transparência metodológica.

3.2. Entrevistas qualitativas

3.2.1. Amostragem e seleção dos participantes

A segunda etapa metodológica concentrou-se na recolha de dados primários através da realização de 13 entrevistas qualitativas semiestruturadas. Utilizou-se uma amostragem intencional (*purposive sampling*) para assegurar a diversidade de perspetivas institucionais e a representatividade territorial.

Os participantes foram recrutados estrategicamente, muitas vezes por referência direta de interlocutores na área, garantindo a inclusão de atores-chave envolvidos com a Iniciativa LEADER e com os mecanismos de financiamento do desenvolvimento rural da UE. A amostra incluiu um espectro completo de visões (decisores políticos, peritos técnicos e coordenadores executivos), integrando: uma representante da UE, ex-ministros, autarcas, dirigentes de ministérios e organismos públicos (como IFAP, CCDR, Rede Rural Nacional), representantes de municípios e coordenadores de GAL. Note-se que uma entrevista foi realizada por escrito e outra agregou as perspetivas de três representantes da Minha Terra - Federação Portuguesa das Associações de Desenvolvimento Local.

3.2.2. Procedimento e análise

As entrevistas foram conduzidas entre junho de 2024 e março de 2025, em formato presencial ou online, com uma duração média entre 30 e 60 minutos. Mediante consentimento prévio, todas as entrevistas foram gravadas em áudio e integralmente transcritas para posterior análise.

O guião de entrevista foi desenhado com base numa estrutura analítica derivada da revisão sistemática da literatura e organizado em cinco dimensões temáticas principais: (1) avaliação da abordagem LEADER, (2) evolução do modelo de governação, (3) situação atual dos GAL, (4) principais desafios enfrentados e (5) estratégias e perspetivas futuras. Estas cinco dimensões temáticas principais permitiram um aprofundamento progressivo das seguintes questões:

- Introdução contextual: Descrição do papel profissional e do percurso dos participantes na Iniciativa LEADER;
- Análise retrospetiva (avaliação histórica): Exame dos principais marcos do programa, mudanças políticas e pontos fortes/fracos percebidos (correspondente à avaliação da abordagem LEADER e à evolução do modelo de governação);
- Crítica contemporânea (realidades operacionais): Identificação das barreiras atuais ao desenvolvimento territorial e da situação operacional dos GALs, com foco nas complexidades da governação multinível (correspondente aos principais desafios enfrentados);
- Prioridades estratégicas futuras: Discussão de perspetivas futuras, otimização de instrumentos financeiros e a evolução do mandato estratégico dos GALs.

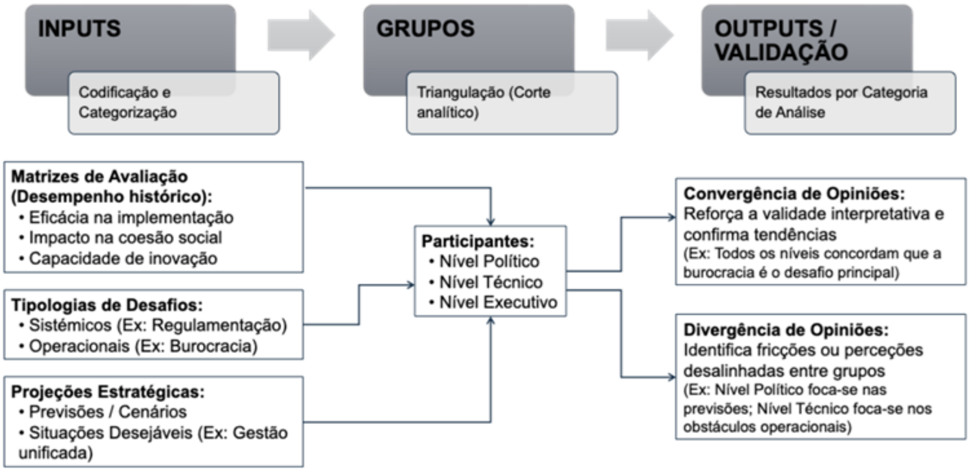
3.2.3. Tratamento e análise dos dados

A análise de conteúdo foi executada utilizando o software NVivo® (versão 1.7.2). Aplicou-se a codificação dedutiva em estrita conformidade com o quadro analítico previamente estabelecido, permitindo uma categorização sistemática das transcrições.

A taxonomia de codificação resultante organizou as respostas em três eixos principais: matrizes de avaliação (desempenho histórico), tipologias de desafios (naturezas sistémicas vs. operacionais) e projeções estratégicas (previsões e situações desejáveis).

Conforme ilustrado na Figura 2, o processo metodológico de análise incluiu a triangulação dos dados entre as categorias de participantes (níveis político, técnico e executivo). Este cruzamento sistemático dos *insights* extraídos por categoria temática com as perspetivas dos diferentes níveis de intervenientes foi crucial para reforçar a validade interpretativa dos resultados e mitigar o risco associado ao número limitado de entrevistas.

Figura 2. Esquema de triangulação metodológica da análise de entrevistas.



Fonte: Elaboração própria

3.2.4. Limitações e estratégias de mitigação

Embora o número de entrevistas seja limitado, a seleção rigorosa dos participantes garantiu a redundância informacional nos temas centrais da investigação. A robustez e a validade das conclusões foram asseguradas através da seleção criteriosa dos entrevistados (com alta representatividade), da clareza das dimensões analíticas que guiaram a codificação e da utilização do NVivo® para a sistematização rigorosa dos dados. A triangulação com os dados recolhidos na etapa documental reforçou adicionalmente a fiabilidade da análise.

4. RESULTADOS

Lançada em 1991, a Iniciativa Comunitária LEADER surgiu como uma resposta da UE às dificuldades estruturais das zonas rurais desfavorecidas, promovendo o desenvolvimento local através da valorização das dinâmicas de base territorial. Portugal aderiu à iniciativa com a criação das Associações de Desenvolvimento Local (ADL), entidades compostas por parceiros socioeconómicos representativos dos respetivos territórios, com uma maioria do setor privado. Esta arquitetura institucional visava fomentar estratégias locais integradas e participativas, implementadas por GAL.

Foram inicialmente reconhecidas 20 ADL, cada uma responsável pela elaboração da sua Estratégia de Desenvolvimento Local (EDL), com o apoio de um envelope financeiro de quatro milhões de euros, proveniente do FEDER, FSE e Fundo Europeu de Orientação e Garantia Agrícola (FEOGA) (Corte-Real et al., 2025). A filosofia da abordagem assentava em sete princípios orientadores: territorialidade, abordagem ascendente (*bottom-up*), multissetorialidade, parcerias, trabalho em rede, cooperação e, inovação, com uma gestão descentralizada.

4.1. Da experimentação à profissionalização

A fase inicial da implementação da Abordagem LEADER foi marcada por um esforço significativo de mobilização dos atores locais e pela superação de resistências. Como refere um entrevistado:

"*Nessa altura, no primeiro LEADER eram só 20 GAL que foram constituídos quase por uma obrigação (...) era preciso quase que andar atrás das pessoas para se unirem, para constituírem um grupo de ação local porque era uma abordagem totalmente nova e uma filosofia totalmente nova e curiosamente ali, com uma grande diferenciação a norte do Tejo e a sul do Tejo...*" (Entrevistado 1).

Apesar das dificuldades iniciais, os GAL evoluíram de forma positiva, adquirindo competências técnicas e reforçando a sua autonomia. Os projetos abrangiam múltiplas áreas – desde o turismo rural ao património histórico, artesanato, vitivinicultura e serviços sociais – promovendo um desenvolvimento verdadeiramente integrado:

"*Era desenvolvimento integrado, tinha projetos de recuperação de património histórico, projetos de instalação de turismo em espaço rural (...), projetos de artesanato, projetos de adegas, as salas de prova de vinhos que na altura não havia nada, começou tudo a aparecer nessa altura. Projetos de formação, projetos sociais, nós tínhamos os serviços de proximidade.*" (Entrevistado 2).

4.2. A transformação com o PRODER e a perda de autonomia

Com o fim da Iniciativa Comunitária, pós LEADER+, a abordagem foi integrada no Programa de Desenvolvimento Rural (PRODER) (2007-2013), no âmbito do II Pilar da PAC. Esta transição marcou uma inflexão relevante na dinâmica da AL, substituindo o modelo experimental por uma lógica administrativa mais rígida e centralizada. Vários entrevistados destacam esta mudança como uma perda de autonomia estratégica:

- "*Quando eu fiz o primeiro embate no LEADER (...) aquilo fez-me, de facto, caso de confusão (...) o Estado pouco poder tinha para decidir o que quer que seja. (...) percebi que as pessoas que trabalhavam no LEADER tinham uma cultura completamente diferente das pessoas que vinham da Agricultura (...), era uma abordagem muito mais de desenvolvimento local.*" (Entrevistado 3).
- "*O aspeto positivo central continua a ser a própria abordagem em si (...) o poder dos territórios terem alguma, para não dizer total (...), autonomia naquilo que é a definição das suas estratégias territoriais.*" (Entrevistado 1).

A subordinação à lógica agrícola e à norma comunitária teve implicações diretas: redução das tipologias de projetos elegíveis e limitação da diversidade de intervenções. Segundo um dos entrevistados, a restrição de 2013 afetou seriamente a capacidade dos GAL:

"*Foi uma decisão política (...) de restringir o âmbito das medidas (...) às de caráter agrícola. (...) nós apoiávamos uma diversidade de medidas (...), tudo que nós apoiávamos (...) entendeu-se que não deveriam ter enquadramento no contexto agrícola (...) ficaram extremamente limitados.*" (Entrevistado 4)

4.3. O modelo DLBC e os desafios da gestão multifundos

No período seguinte, emergiu o DLBC, uma tentativa de recuperar o enfoque territorial da Abordagem LEADER, agora alargado a zonas urbanas e costeiras. Embora o modelo multifundos tenha oferecido maior potencial estratégico, a sua operacionalização revelou-se excessivamente burocratizada, minando a capacidade de atuação dos GAL:

- "*A gestão multifundos, era muito complicada (...), tornou-se um pandemónio.*" (Entrevistado 3);
- "*Temos uma estratégia que está partilhada entre várias autoridades de gestão (...) cada um deles com interesses um bocadinho diferentes.*" (Entrevistado 1).

Além disso, a pressão administrativa e o excesso de tipificação dos projetos levaram à descaracterização da função dinamizadora dos GAL:

"Os GAL deixaram de ter um papel fundamental (...) não fazem animação praticamente porque os projetos estão de tal maneira tipificados, que eles fazem um trabalho como o Ministério faz (...),

deixou de assumir um certo risco que devia assumir juntamente com o cidadão (...), e com isto foi matando a inovação nos territórios rurais." (Entrevistado 1).

4.4. Reflexões finais e propostas de reconfiguração

Apesar das críticas, é unânime entre os entrevistados o reconhecimento do valor da abordagem LEADER e da necessidade de lhe devolver protagonismo territorial. O contexto atual, marcado por uma excessiva centralização e por um modelo de gestão compartimentado, exige reformas estruturais. Destaca-se a importância de uma autoridade de gestão única para os fundos multifundos, como já acontecia no LEADER II:

- "*Eu só consigo acreditar que um programa plurifundo consiga funcionar bem se ele tiver uma autoridade de gestão dedicada a isso (...).*" (Entrevistado 1).
- "*Era uma comissão de gestão em que estavam representados os 3 fundos, mas o fundo estava na mão do gestor (...) e, portanto, os 3 fundos podiam opinar, mas o fundo estava na mão de um só gestor.*" (Entrevistado 1)

Outro ponto central prende-se com a redefinição da delimitação territorial dos GAL. Embora alguns defendam o alinhamento com as CIM, outros argumentam que a lógica *bottom-up* e a tradição dos GAL pré-existentes devem ser preservadas:

- "*O nosso país é pequeno, mas é diferente. É diferente Minho, não tem nada a ver com Alentejo. Trás-os-Montes não tem nada a ver com Algarve (...). Somos diferentes.*" (Entrevistado 5);
- "*Parece-me que, enquanto desenvolvimento territorial, (...) os GAL continuam a ser importantes, sobretudo em áreas onde os pequenos atores (...) não conseguem enfrentar os novos desafios (...).*" (Entrevistado 6).

O Quadro 4 resume os principais resultados empíricos obtidos a partir dos testemunhos recolhidos em entrevistas qualitativas sobre a implementação da abordagem LEADER em Portugal. Os temas centrais são acompanhados por evidências diretas dos entrevistados e os respetivos impactos observados nos territórios.

Quadro 4. Síntese dos principais resultados e evidências da abordagem LEADER em Portugal

Tema	Evidência/Declaração dos Entrevistados	Impacto/Resultado Observado
Implementação inicial do LEADER	"*Era preciso quase que andar atrás das pessoas para se unirem, para constituírem um grupo de ação local…*" (Entrevistado 1)	Dificuldade inicial de mobilização, abordagem inovadora e desconhecida.
Assimetria regional Norte/Sul	"*A norte do Tejo, com um poder muito marcado das autarquias (...), a sul uma lógica muito mais associativa.*" (Entrevistado 1)	Diferentes dinâmicas de constituição dos GAL; influência da cultura política local.
Desenvolvimento integrado	"*Projetos de património, turismo rural, artesanato, adegas, formação, serviços de proximidade.*" (Entrevistado 2)	Valorização multissetorial do território; dinamização da economia e da coesão social.
Autonomia e abordagem ascendente	"*As pessoas que trabalhavam no LEADER tinham uma cultura completamente diferente das da Agricultura.*" (Entrevistado 3)	Modelo diferenciado e próximo da realidade local; empoderamento da sociedade civil.
Transição para o PRODER (pós-2007)	"*Perdeu-se a autonomia local, a definição da estratégia local (...).*" (Entrevistado 7)	Integração na PAC trouxe centralização, padronização e rigidez burocrática.
Restrição de medidas apoiadas (2013)	"*Foi uma decisão política (...) de restringir o âmbito às medidas agrícolas.*" (Entrevistado 4)	Redução do leque de projetos; GAL passaram a apoiar quase exclusivamente agricultura.
Excesso de burocracia no DLBC	"*Tornou-se um pandemónio.*" (Entrevistado 3) "*Cada fundo com regras diferentes.*" (Entrevistado 1)	Dificuldade de execução dos fundos; perda de tempo e foco na dinamização territorial.
Perda do papel animador dos GAL	"*Os GAL não fazem animação, só verificam elegibilidades (...).*" (Entrevistado 3)	Descaracterização do papel estratégico e mobilizador dos GAL.
Importância da gestão unificada	"*Só acredito num programa plurifundo se tiver uma autoridade de gestão dedicada.*" (Entrevistado 3)	Necessidade de estrutura única para garantir coerência e eficiência operacional.
Desajuste territorial e rejeição da padronização	"*O nosso país é pequeno, mas é diferente. Minho não tem nada a ver com o Alentejo.*" (Entrevistado 5)	A padronização ignora especificidades regionais e fragiliza a eficácia territorial.
Propostas de futuro	"*Devolver aos GAL o seu papel animador, dinamizador e muito ligado aos atores locais.*" (Entrevistado 6)	Reafirmação da importância da abordagem *bottom-up* e de soluções localizadas.

Fonte: Elaboração própria

Os resultados (Quadro 4) confirmam a importância estratégica da abordagem LEADER como motor de desenvolvimento territorial sustentável. Contudo, evidenciam a urgência de reformular os modelos de governação e financiamento, com base em princípios de descentralização, participação e flexibilidade, para enfrentar os desafios estruturais das zonas rurais em Portugal.

5. DISCUSSÃO

Os resultados apresentados evidenciam que a abordagem LEADER teve um papel estruturante no desenvolvimento rural português ao longo das últimas décadas, particularmente nas primeiras fases em que a autonomia local, a experimentação e o envolvimento direto dos atores territoriais foram centrais. Esta abordagem permitiu não apenas ativar capital social e redes de cooperação, mas também promover soluções territorializadas e ajustadas às necessidades locais, tal como defendido por Ray (2000) e High & Nemes (2007).

A análise das entrevistas revela que a abordagem LEADER teve como trunfo a valorização da diversidade regional e a liberdade estratégica concedida aos GAL, permitindo-lhes desenhar intervenções adaptadas aos seus contextos específicos. Essa autonomia, contudo, foi gradualmente limitada com a integração da abordagem no PRODER e posteriormente no DLBC (Corte-Real et al., 2025). A crescente centralização e padronização das regras de financiamento, apontadas por vários entrevistados, estão em consonância com críticas feitas na literatura à burocratização das políticas territoriais da UE (Shucksmith, 2010; Scott et al., 2013; Tiganasu, R., & Lupu, 2023).

Além disso, os dados empíricos sugerem que a perda da componente animadora e inovadora dos GAL está associada à sua crescente função administrativa, agora focada na verificação de conformidades e elegibilidades. Tal desvio da missão original compromete a natureza participativa e transformadora da abordagem *bottom-up*, um dos seus principais pilares metodológicos (Dargan & Shucksmith, 2008; Chevalier & Vollet, 2019). Como observou um entrevistado, "*os GAL deixaram de ter um papel fundamental*", limitando-se a replicar funções da administração central, o que resulta na estandardização dos projetos e na estagnação da inovação.

A gestão multifundos do DLBC, embora teoricamente promissora, revelou-se excessivamente complexa, contribuindo para a sobrecarga administrativa dos GAL e afastando-os da sua vocação de dinamizadores locais. Esta constatação confirma os alertas feitos por Esparcia (2014) e Corte-Real et al. (2025), que salientam a importância da articulação institucional simplificada como condição para o sucesso do desenvolvimento local integrado.

Outra questão importante emergente diz respeito à tensão entre a lógica agrícola dominante e a lógica territorial da abordagem LEADER. Ao restringir os apoios a medidas de caráter estritamente agrícola, as autoridades de gestão limitaram o potencial transformador dos projetos LEADER, contrariando a visão da Comissão Europeia sobre a multifuncionalidade do espaço rural (Daniel & Perraud, 2009). A crítica à "agriculturalização" do desenvolvimento rural também é amplamente abordada por Van der Ploeg et al. (2000), ao destacarem a necessidade de políticas rurais mais inclusivas e intersetoriais.

Finalmente, destaca-se um amplo consenso entre os entrevistados quanto à importância de restituir o papel estratégico aos GAL, promovendo uma revalorização da abordagem ascendente, da proximidade aos territórios e da experimentação. Neste sentido, reforça-se a pertinência das propostas que apontam para a criação de uma autoridade de gestão dedicada e unificada, como condição para a operacionalização eficaz de futuros modelos multifundos (Shortall, 2008).

Assim, os resultados deste estudo contribuem para a discussão sobre o futuro da política de desenvolvimento rural em Portugal, sublinhando a necessidade de reequilibrar os modelos de governação, valorizando novamente a dimensão local e o papel das comunidades na construção das suas estratégias.

6. CONCLUSÕES E IMPLICAÇÕES PARA A GOVERNANÇA DO DESENVOLVIMENTO RURAL

6.1. Conclusões

A análise realizada neste estudo evidencia que a abordagem LEADER representou, durante as suas primeiras fases, uma rutura positiva e essencial face aos modelos tradicionais de intervenção pública, ao promover dinâmicas territoriais baseadas na participação local, na mobilização de recursos endógenos e numa lógica de governação ascendente. O reconhecimento do papel estratégico dos GAL, compostos maioritariamente por atores da sociedade civil e com forte enraizamento no território, contribuiu decisivamente para a revitalização de muitas zonas rurais em Portugal, em áreas como o turismo, o artesanato, os serviços de proximidade e a valorização do património. Contudo, os resultados obtidos através das entrevistas revelam um padrão progressivo de recentralização e burocratização, particularmente acentuado com a integração do LEADER nos programas PRODER e, posteriormente, no modelo DLBC. Esta evolução comprometeu vários dos princípios fundadores da abordagem, resultando na perda de autonomia e capacidade inovadora dos GAL para responderem às especificidades territoriais. A padronização excessiva de procedimentos, associada à fragmentação dos fundos e à ausência de uma entidade de gestão única, resultou numa perda significativa da eficácia operacional e no enfraquecimento da sua função dinamizadora.

Verifica-se, ainda, uma clivagem persistente entre o entendimento do desenvolvimento rural enquanto realidade multifacetada e o predomínio de uma visão setorial ainda demasiado centrada na agricultura, dificultando o financiamento de iniciativas locais inovadoras, não agrícolas, mas essenciais à coesão territorial.

É fundamental sublinhar que a defesa do papel dos GAL deve ser balizada por uma análise crítica. Embora o potencial transformador dos GAL seja inegável, o estudo aponta para limites estruturais à sua ação: a dependência excessiva de financiamento da UE, a dificuldade em garantir a sustentabilidade de projetos pós-apoio e, crucialmente, a existência de assimetrias de poder interno que podem desvirtuar o princípio da participação (limitando, por vezes, a ação a uma elite local ou a interesses específicos). Os GAL não são imunes à inércia institucional e a burocratização externa acaba por ecoar nas suas próprias dinâmicas internas de gestão, tornando o seu *modus operandi* por vezes mais técnico-administrativo do que verdadeiramente ascendente.

Neste contexto, a recuperação do potencial transformador da abordagem LEADER não é passiva. Exige um reposicionamento estratégico que que não se limite à simplificação administrativa.

Os dados sugerem que o modelo de governação futuro deve ser descentralizado de forma real e vinculativa, ancorado numa gestão plurifundos simplificada e concentrada numa única entidade coordenadora, dotada de autonomia técnica e administrativa para além das influências setoriais tradicionais. Esta proposta desafia o modelo de gestão fragmentada atualmente em vigor, defendendo a urgência de um mandato estratégico mais robusto para os GAL, que lhes permita atuar como verdadeiros polos de inovação territorial, e não apenas como meros intermediários financeiros.

Em suma, a experiência portuguesa com o LEADER confirma o valor inestimável de uma abordagem de base local, mas evidencia o perigo da sua essência ser diluída pela institucionalização e tecnocracia. As aprendizagens acumuladas exigem a construção de modelos futuros que estabeleçam um novo equilíbrio entre exigência administrativa e capacidade de risco e inovação local, assegurando que os GAL possam ser agentes centrais na promoção de territórios mais coesos e resilientes, desafiando a inércia setorial vigente.

6.2. Recomendações e projeções para o futuro do LEADER

Com base nos dados empíricos e na análise crítica da evolução da abordagem LEADER em Portugal, é possível identificar um conjunto de recomendações cruciais, as quais se projetam sobre os desafios futuros que moldarão o desenvolvimento territorial.

6.2.1. Estratégias de revitalização e ação imediata

É fundamental implementar as seguintes medidas para garantir a eficácia da abordagem no curto prazo:

- Reforço da autonomia estratégica e redefinição territorial dos GAL: É imperativo devolver a capacidade de decisão e implementação descentralizada aos GAL. Esta autonomia deve ser acompanhada por uma reavaliação do seu desenho territorial. Embora a flexibilidade seja crucial, uma eventual redefinição dos perímetros de ação pode otimizar a massa crítica, recursos e a coerência geográfica. O obstáculo principal é a resistência institucional e a complexidade administrativa de tal reconfiguração, mas a sua viabilidade assenta na comprovada capacidade dos GAL de gerir estratégias de desenvolvimento local (DLBC);
- Simplificação burocrática e racionalização processual: redução drástica da carga administrativa (candidaturas, aprovação e pagamento) é imperativa. Esta racionalização libertará recursos dos GAL para o seu papel primordial de dinamização, acompanhamento e capacitação junto dos atores locais;
- Revalorização do carácter inovador: Os programas devem resgatar a sua margem de flexibilidade e experimentação, incentivando soluções criativas e de risco que abordem a inovação social, a economia circular e a transição ecológica como motores de desenvolvimento;
- Financiamento integrado (plurifundos) e governança colaborativa: Assegurar que os diferentes fundos (FEADER, FEDER, FSE+, MAR) operam sob gestão única e coordenada, evitando sobreposições e conflitos de regras. O sucesso exige uma governança multinível e colaborativa, baseada na confiança e na corresponsabilização;
- Capacitação técnica e renovação geracional: A formação contínua dos técnicos, aliada ao rejuvenescimento das equipas, é determinante para garantir a capacidade de resposta aos novos desafios tecnológicos, ambientais e demográficos.

6.2.2. Gestão unificada de fundos: Viabilidade e obstáculos

A proposta de assegurar que os diferentes fundos europeus (FEADER, FEDER, FSE+, MAR) operem sob gestão única e coordenada é a chave para eliminar sobreposições, conflitos de regras e a fragmentação das estratégias.

A gestão unificada é tecnicamente viável, exigindo a designação de uma autoridade de gestão única dedicada ao LEADER/DLBC, responsável por harmonizar as regras de elegibilidade, monitorização e pagamento entre os diferentes fundos. Modelos semelhantes de coordenação de fundos já foram explorados noutros Estados-Membros, com sucesso na simplificação. O principal obstáculo reside na fragmentação institucional e na resistência dos diversos organismos gestores setoriais em ceder competências. Requer uma forte decisão política ao nível central e um esforço de uniformização regulamentar a nível nacional.

6.2.3. Projeções e o papel do LEADER no futuro (pós-2027)

O futuro do LEADER deve ser traçado em linha com as tendências globais e as reformas da União Europeia. Propõe-se que a abordagem se foque nos seguintes vetores:

- Resposta à digitalização e às alterações climáticas: O LEADER deve ser um veículo para a transformação verde e digital dos territórios rurais. Isto implica financiar a infraestrutura digital de proximidade, projetos de eficiência energética, adaptação climática e o desenvolvimento de competências digitais nas comunidades;
- Reconhecimento do papel estratégico do rural: As políticas públicas devem reconhecer o meio rural como um espaço de inovação, sustentabilidade e resiliência nacional e europeia, abandonando a perspetiva residual. A superação das disparidades exige políticas verdadeiramente territoriais, adaptadas às especificidades locais;
- Posicionamento no contexto pós-2027: Num cenário de alargamento da UE e contenção orçamental, o LEADER deve demonstrar a sua mais-valia e eficácia, reforçando a sua função de:

- Instrumento de coesão social: Promover ativamente a participação cidadã e o envolvimento da sociedade civil, garantindo que as comunidades definem as prioridades estratégicas, para além do formalismo;

- Mecanismo de articulação e integração: Assegurar a ligação real e funcional entre a PAC e a Política de Coesão, evitando incoerências e maximizando o impacto no mundo rural;

• Melhoria da monitorização e da avaliação de impacto: Desenvolver mecanismos robustos que utilizem indicadores qualitativos e quantitativos (incluindo dados de tendências futuras e impacto sistémico) para aferir o efeito real e a pegada territorial das intervenções na coesão e resiliência.

REFERÊNCIAS

Ahlmeyer, F., & Volgmann, K. (2023). What Can We Expect for the Development of Rural Areas in Europe? – Trends of the Last Decade and Their Opportunities for Rural Regeneration. *Sustainability, 15*(6), 5485. https://doi.org/10.3390/su15065485

Bosworth, G., Annibal, I., Carroll, T., Price, L., Sellick, J., & Shepherd, J. (2015). Empowering Local Action through Neo-Endogenous Development; The Case of LEADER in England. *Sociologia Ruralis, 56*(3), 427-449. https://doi.org/10.1111/soru.12089

Bosworth, G., Price, L., Hakulinen, V., & Marango, S. (2020). Rural Social Innovation and Neo-endogenous Rural Development. In E. Cejudo, and F. Navarro (Eds.), *Neoendogenous Development in European Rural Areas* (Chapter 2, pp. 21-32), New York: Springer Geography. doi:10.1007/978-3-030- Q4 33463-5_2

CE (2025). *A política agrícola comum de relance*. Agriculture and rural development. Comissão Europeia. Disponível em https://agriculture.ec.europa.eu/common-agricultural-policy/cap-overview/cap-glance_pt (acedido a 12 de maio de 2025)

CEDRU (2022). Roteiro para a Capacitação do Ecossistema dos Fundos da Política da Coesão para o período 2012-2017. Relatório Final. Lisboa: CEDRU. Disponível em: https://www.adcoesao.pt/wp-content/uploads/Roteiro_RFinal_junho2022.pdf (acedido a 29 de maio de 2025)

Chevalier, P., & Vollet, D. (2019). LEADER 2007–2013: An innovation dependent on local and national institutional arrangements? Some European illustrations. Regional Science Policy & Practice, 11(2), 219-235. https://doi.org/10.1111/rsp3.12156

Corte-Real, M., Jardim, E., & Oliveira, A. P. (2025). Local governance in rural Portugal: evolution and impact of LEADER program – a qualitative approach. *European Planning Studies*, 1-22. https://doi.org/10.1080/09654313.2025.2516781

Cotella, G. (2020). How Europe hits home? The impact of European Union policies on territorial governance and spatial planning. Géocarrefour, 94(3). https://doi.org/10.4000/geocarrefour.15648

CUE (2025). *Cronologia – História da PAC*. Conselho Europeu, Conselho da União Europeia. Disponível em https://agriculture.ec.europa.eu/common-agricultural-policy/cap-overview/cap-glance_pt (acedido a 12 de maio de 2025)

Daniel, F.-J., & Perraud, D. (2009). The multifunctionality of agriculture and contractual policies. A comparative analysis of France and the Netherlands. Journal of Environmental Management, 90, S132-S138. https://doi.org/10.1016/j.jenvman.2008.11.015

Dargan, L., & Shucksmith, M. (2008). LEADER and innovation. *Sociologia Ruralis, 48*(3), 274-291. 8 https://doi.org/10.1111/j.1467-9523.2008.00463.x

Dax, T., & Copus, A. (2016). The Future of Rural Development in the EU. In European Parliament: Directorate-General for Internal Policies of the Union (Ed.), CAP reform post-2020 - challenges in agriculture – Workshop documentation – Research for AGRI Committee (pp. 221-301). Brussels: European Parliament. https://data.europa.eu/doi/10.2861/719222

Dax, T., & Hovorka, G. (2007). The territorial dimension of the Common Agricultural and Rural Development policy (CAP) and its relation to cohesion objectives. *Munich Personal RePEc Archive, 6572*, 14 pp. https://mpra.ub.uni-muenchen.de/6572/1/MPRA_paper_6572.pdf

DG AGRI (2009). *Health Check of the CAP*. European Commission, Directorate-General for Agriculture and Rural Development. Disponível em https://eur-lex.europa.eu/EN/legal-content/summary/health-check-of-the-cap-reform.html (acedido a 08 de setembro de 2025)

EC (2018). *The Future of Food and Farming*. European Commission, COM(2017)713. Disponível em https://ec.europa.eu/enrd/sites/default/files/assembly4_futurecap_castellano.pdf (acedido a 08 de setembro de 2025)

EC (2022). *EU Cohesion Policy: €23 billion for the economic and social development of Portugal in 2021-2027*. European Commission. Disponível em: https://ec.europa.eu/regional_policy/en/newsroom/news/2022/07/15-07-2022-eu-cohesion-policy-eur23-billion-for-the-economic-and-social-development-of-portugal-in-2021-2027 (acedido a 30 de maio de 2025)

EC (2025a). *History of the policy*. European Commission. Disponível em https://ec.europa.eu/regional_policy/policy/what/history_en (acedido a 1 de junho de 2025)

EC (2025b). *The impact of the common agricultural policy on generational renewal, local development and jobs in rural areas*. Agriculture and rural development. European Commission. Disponível em : https://agriculture.ec.europa.eu/common-agricultural-policy/cap-overview/cmef/rural-areas/impact-common-agricultural-policy-generational-renewal-local-development-and-jobs-rural-areas_en (acedido a 30 de maio de 2025)

EC (2025c). *Portugal – CAP Strategic Plan*. Agriculture and rural development. European Commission. Disponível em https://agriculture.ec.europa.eu/cap-my-country/cap-strategic-plans/portugal_en (acedido a 30 de maio de 2025)

ELARD (2025). Exploring new avenues: LEADER's Role in a renewed and more coherent rural vision for Europe. ELARD Press Release. Disponível em https://elard.eu/exploring-the-issue/ (acedido a 2 de junho de 2025)

Esparcia, J. (2014). Innovation and networks in rural areas. Journal of Rural Studies, 34, 1-14. https://doi.org/10.1016/j.jrurstud.2013.12.004

Estevam, D. O, & Santos, M. J. (2018). The trajectory of the common agricultural policy and its impact on portuguese agriculture following accession to the European Union. *International Journal of Development Research, 8*(3), 19500-19510. https://www.journalijdr.com/sites/default/files/issue-pdf/12596.pdf

EU (2007). *Tratado de Lisboa que altera o Tratado da União Europeia e o Tratado que institui a Comunidade Europeia, assinado em Lisboa em 13 de dezembro de 2007*. Jornal Oficial da União Europeia, C 306, 17 de dezembro de 2007

EU (2023). *Evaluation support study of the costs and benefits of the implementation of LEADER – Final report*. European Commission: Directorate-General for Agriculture and Rural Development. Publications Office of the European Union. Disponível em: https://data.europa.eu/doi/10.2762/995751 (acedido a 9 fevereiro 2025)

EU (2025). *LEADER/CLLD explained*. European Network for Rural Development (ENRD). EU CAP Network website. Disponível em: https://ec.europa.eu/enrd/leader-clld/leader-toolkit/leaderclld-explained_en.html (acedido a 9 fevereiro 2025)

Faludi, A. (2006) From European spatial development to territorial cohesion policy. *Regional Studies, 40*(6), 667-678. DOI: 10.1080/00343400600868937

FAO (2008). *The Evolution and Impact of EU Regional and Rural Policy*. FAO Investment Centre/World Bank Working Paper. FAO: Roma (Itália). Disponível em: https://openknowledge.fao.org/server/api/core/bitstreams/4c3134a1-1d3a-4825-98a3-e64460babbce/content (acedido a 24 de junho de 2025)

Ferrão, J., & Lopes, R. (2004). Understanding Peripheral Rural Areas as Contexts for Economic Development. In L. Labrianidis (Ed.), The Future of Europe's Rural Peripheries (1st Edition, Chapter 2, 31 pp.). London: Routledge

High, C., & Nemes, G. (2007). Social learning in LEADER: Exogenous, endogenous and hybrid evaluation in rural development. Sociologia Ruralis, 47(2), 103-119. https://doi.org/10.1111/j.1467-9523.2007.00430.x

Ledezma, J. F. M. (2023). Rediscovering rural territories: Local perceptions and the benefits of collective mapping for sustainable development in Colombian communities. *Research in Globalization, 7*, 100153. https://doi.org/10.1016/j.resglo.2023.100153

Lowe, P., Buller, H., & Ward, N. (2002). Setting the next agenda? British and French approaches to the second pillar of the Common Agricultural Policy. *Journal of Rural Studies, 18*(1), 1-17. https://doi.org/10.1016/S0743-0167(01)00025-0

Matthews, A. (2013). Greening agricultural payments in the EU's Common Agricultural Policy. *Bio-Based and Applied Economics, 2*(1), 1-27. https://doi.org/10.13128/BAE-12179

Medeiros, E. (2013). Assessing Territorial Impacts of the EU Cohesion Policy: The Portuguese Case. *European Planning Studies, 22*(9), 1960-1988. https://doi.org/10.1080/09654313.2013.813910

Medeiros, E. (2018). Territorial Development Strategies and EU Cohesion Policy. European Structural and Investment Funds Journal, 6(1), 68-85. https://estif.lexxion.eu/data/article/12289/pdf/estif_2018_01-012.pdf

Medeiros, E. (2020). Portugal 2020: An Effective Policy Platform to Promote Sustainable Territorial Development? *Sustainability, 12*(3), 1126. https://doi.org/10.3390/su12031126

Monteiro, A. A. (2019). Territórios do interior, coesão territorial e modelos de governança: a propósito do programa nacional para a coesão territorial. *Sociologio Online, 19*, 127-151. DOI: 10.30553/sociologiaonline.2019.19.6

OECD (2020). *Rural Well-being: Geography of opportunities*. OECD Country Note. Disponível em: https://www.oecd.org/content/dam/oecd/en/publications/reports/2024/12/rural-well-being-country-notes_d66ebd53/portugal_409e2540/fb15f143-en.pdf (acedido a 2 junho 2025)

Pereira, V. J., & Martinho, D. (2017). Insights from over 30 years of common agricultural policy in Portugal. Outlook on Agriculture, 46(3), 223-229. https://doi.org/10.1177/0030727017729896

Portugal 2020 – página oficial. https://portugal2020.pt/

Portugal 2030 – página oficial. https://portugal2030.pt/

Ray, C. (2000). Endogenous socio-economic development in the European Union: Issues of evaluation. *Journal of Rural Studies, 16*(4), 447-458. https://doi.org/10.1016/S0743-0167(00)00012-7

Schuh, B., Gaupp-Berghausen, M., Munch, A., Badouix, M., Hat, K., & Brkanovic, S. (2022). *Research for AGRI Committee – The Future of the European Farming Model: Socio-economic and territorial implications of the decline in the number of farms and farmers in the EU*. European Parliament, Policy Department for Structural and Cohesion Policies, Brussels. Disponível em https://www.europarl.europa.eu/thinktank/en/document/IPOL_STU(2022)699620 (acedido a 4 junho 2025)

Scott, A. J., Carter, C., Reed, M. R., Larkham, P., Adams, D., Morton, N., Waters, R., Collier, D., Crean, C., Curzon, R., Forster, R., Gibbs, P., Grayson, N., Hardman, M., Hearle, A., Jarvis, D., Kennet, M., Leach, K., Middleton, M., Schiessel, N., Stonyer, B., & Coles, R. (2013). Disintegrated development at the rural–urban fringe: Re-connecting spatial planning theory and practice. Progress in Planning, 83, 1-52. https://doi.org/10.1016/j.progress.2012.09.001

Shortall, S. (2008). Are rural development programmes socially inclusive? Social inclusion, civic engagement, participation, and social capital: Exploring the differences. Journal of Rural Studies, 24(4), 450-457. https://doi.org/10.1016/j.jrurstud.2008.01.001

TerritorialAgenda (2020). *Agenda Territorial 2030*. Disponível em: https://territorialagenda.eu/pt-pt/ (acedido a 2 junho 2025)

Tiganasu, R., & Lupu, D. (2023). Institutional quality and digitalization: Drivers in accessing European funds at regional level? Socio-Economic Planning Sciences, 90, 101738. https://doi.org/10.1016/j.seps.2023.101738

Tribunal Contas Europeu (2022). *O LEADER e o desenvolvimento local de base comunitária facilitam a participação local, mas os benefícios adicionais não estão suficientemente demonstrados*. Relatório especial 19/2022. Tribunal de Contas Europeu. Disponível em: https://www.eca.europa.eu/Lists/ECADocuments/SR22_10/SR_Leader_PT.pdf (acedido a 8 setembro 2025)

Van der Ploeg, J. D., Renting, H., Brunori, G., Knickel, K., Mannion, J., Marsden, T., De Roest, K., Sevilla-Guzmán, E., & Ventura, F. (2000). Rural development: From practices and policies towards theory. Sociologia Ruralis, 40(4), 391-408. https://doi.org/10.1111/1467-9523.00156

Viegas, M., Batista, P., & Cordovil, F. (2023). The Portuguese Forest and the Common Agricultural Policy. *Landscape Ecology, 38*, 3637-3656. https://doi.org/10.1007/s10980-023-01748-1

Vilares, E., & Moreira, P. (2021). Time to act on the Territorial Agenda. Territorial Agenda – A future for all places. Disponível em https://territorialagenda.eu/news-articles/time-to-act-on-the-territorial-agenda/ (acedido a 3 junho 2025).

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O Turismo em Territórios de Baixa e Alta Densidade: a Perspetiva dos Residentes do Centro de Portugal

Tourism in Low- and High-Density Territories: the Perspectives of Residents from Centro de Portugal

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Resumo

A população local desempenha um papel fundamental na gestão sustentável e responsável do turismo. O objetivo deste estudo é compreender as perspetivas dos residentes de territórios de baixa densidade (TBD) do Centro de Portugal, relativamente aos impactos e benefícios do turismo no desenvolvimento local. Com base num questionário online dirigido aos residentes do Centro de Portugal (amostra de 418 inquiridos) foram comparadas as avaliações de 244 residentes de TBD e de 174 residentes de territórios de alta densidade (TAD). Os dados revelam que os inquiridos de TBD atribuem melhor ponderação aos impactos positivos do turismo, bem como a vários aspetos associados ao turismo sustentável e regenerativo. Em contrapartida, os inquiridos de TAD são mais sensíveis às consequências negativas do turismo.

Palavras-Chave: Produto Endógeno; Territórios de Baixa Densidade; Desenvolvimento Local; Residentes; Turismo Regenerativo

Código JEL: Q01, R23, R58, Z32

Abstract

The local population plays a key role in the sustainable and responsible management of tourism. The aim of this study is to understand the perspectives of residents of low-density territories (TBD) in the Centro de Portugal regarding the impacts and benefits of tourism on local development. Based on an online questionnaire addressed to the residents of the Centro de Portugal (a sample of 418 respondents), the ratings of 244 TBD residents and 174 residents of high-density territories (TAD) were compared. The data shows that respondents from TBD give more consideration to the positive impacts of tourism, as well as various aspects associated with sustainable and regenerative tourism. On the other hand, TAD respondents are more sensitive to the negative consequences of tourism.

Keywords: Endogenous Product; Low Density Territories; Local Development; Residents; Regenerative Tourism

JEL Code: Q01, R23, R58, Z32

1. INTRODUÇÃO

O turismo "é uma atividade de pessoas para pessoas", em que as relações humanas e o genuíno interesse de comunhão é reconhecido pelos visitantes (Turismo de Portugal, 2017, p.47). Por isso, a comunidade residente tem um papel essencial na arte de "Receber bem", pois esta atitude, além de diferenciadora, contribui para atrair mais fluxos turísticos para Portugal. Os comportamentos e as ações dos residentes em relação à atividade turística e aos turistas, assumem uma particular importância, sendo um excelente veículo de transmissão da cultura e da identidade do povo português. Aliás, o envolvimento e a interação social da comunidade nas atividades turísticas evidenciam um maior entendimento por parte do turista quanto à cultura dos residentes, tornando assim mais memorável a viagem (Kim, 2014). Pensar o desenvolvimento e a competitividade de um destino, implica considerar, tanto as expectativas dos turistas, como o bem-estar dos residentes e a sustentabilidade dos recursos (Kovačić *et al.*, 2024). Quando participam nos processos de tomada de decisão, os residentes adotam atitudes mais favoráveis em relação ao desenvolvimento do turismo (Easterling, 2004; Reis *et al.*, 2024). A indústria turística tem potencial para revitalizar e dinamizar do ponto de vista físico, económico e social as comunidades de áreas mais desfavorecidas, especialmente as rurais, com baixa densidade (BD) e maioritariamente localizadas no interior do país (Silva, 2013).

O Centro de Portugal foi a região selecionada para este estudo, devido à sua diversidade, quer em termos demográficos, quer em termos de produtos turísticos. Por um lado, ao considerar a localização estratégica desta NUT II, que se estende desde a costa atlântica até à fronteira com a Espanha, encontram-se municípios com distintas características e acentuadas variações de densidade populacional, isto é, embora os TBD predominem na faixa oriental e os TAD sejam maioritários na faixa litoral. Por outro lado, o turismo no Centro de Portugal caracteriza-se pelo seu potencial para uma miríade de produtos turísticos, dada a diversidade do seu património, como por exemplo a gastronomia, a religião, a natureza, a cultura, os vinhos, os centros históricos, as aldeias, etc. (Observatório do Turismo Sustentável do Centro de Portugal, 2025). Neste sentido, visa-se compreender quais as perspetivas da comunidade residente nos TBD desta região, em relação ao contributo do turismo para o desenvolvimento regional. Pretende-se identificar os pontos de vista destes residentes quanto ao potencial do turismo na valorização dos produtos endógenos.

Assim sendo, foi divulgado um questionário online às freguesias dos 100 municípios do Centro de Portugal para compreender que impactos e benefícios o turismo tem sobre os residentes. Este estudo aprofunda a visão dos residentes quanto aos efeitos e contributos do turismo na região Centro, com o objetivo de promover um desenvolvimento regional mais sustentável. Os dados obtidos contribuem para uma melhor compreensão sobre a posição atual dos residentes, e as assimetrias existentes entre a perceção dos inquiridos em TBD e em TAD, quanto aos impactos do turismo no bem-estar das comunidades. Este estudo revela-se particularmente útil e vantajoso para os gestores de destinos, permitindo-lhes obter uma visão abrangente e holística das perceções dos residentes sobre o que é essencial para o desenvolvimento turístico sustentável.

2. REVISÃO DA LITERATURA

2.1. Turismo como fator de desenvolvimento regional

O conceito de desenvolvimento é recorrentemente utilizado para descrever evoluções e melhorias no modo de vida da população, podendo esta evolução assumir inúmeras formas e ocorrer em qualquer parte no mundo (Qureshi, 2019). De facto, a sua análise pode abranger diversas dimensões e escalas variáveis, tais como: regional, nacional, global, local (Willis, 2011). O desenvolvimento regional constitui um processo contínuo, dinâmico e complexo, envolvendo diferentes fatores, sendo, por conseguinte, um conceito multi- e interdisciplinar (Oliveira, 2021). Não existe uma noção fixa ou universal de desenvolvimento regional. Segundo Capello e Nijikamp (2009), há uma dinâmica espaço/temporal complexa das regiões, que influencia desenvolvimento. Minnes e Vodden (2019) descrevem o desenvolvimento regional como uma intervenção planeada e organizada, através de um conjunto de políticas, programas e projetos que visam alcançar objetivos económicos, sociais, ambientais e culturais, e que contribuem para a melhoria do bem-estar e prosperidade das comunidades e regiões.

Para que o desenvolvimento de uma região seja bem-sucedido, é necessário compreender as narrativas identitárias regionais (Piffer *et al.,* 2006), ou seja, a identidade cultural, a história, os valores, as práticas e as tradições locais. Verifica-se que o desenvolvimento regional deve estar em harmonia e intrinsecamente relacionado com as características étnicas e históricas da região, que moldam a sua identidade cultural (Kashimoto *et al.*, 2002). Estas particularidades são essenciais para a implementação de políticas e estratégias de desenvolvimento regional, nos domínios económico, social e cultural. Uma das políticas utilizadas neste contexto de desenvolvimento regional é designada 'Bottom-Up'. Esta abordagem centra-se num desenvolvimento integrado, focado na mobilização dos recursos locais e nas vantagens competitivas que são localmente geridas e exploradas *(*Pike *et al.*, 2006). Estas políticas de desenvolvimento visam estimular o potencial da região, favorecendo as vantagens competitivas e a participação dos agentes locais e da comunidade residente, na aplicação e gestão de estratégias de desenvolvimento.

Devido à globalização, coloca-se em causa a preservação da autenticidade e da cultura regional, onde o paradigma da produção em massa é pouco flexível e muito especializado (Ascani *et al.*, 2012). Em contraste, o desenvolvimento regional valoriza as singularidades regionais, adotando processos de diferenciação que tiram partido daquilo que é único em cada região (Oliveira, 2021).

A indústria turística tem-se revelado um importante motor do desenvolvimento regional (Nascimento *et al.*, 2014). Há evidências empíricas do contributo essencial da indústria turística para o desenvolvimento regional dos territórios (Vareiro & Ribeiro, 2007). O turismo é um meio adequado para explorar e comercializar os produtos locais, promovendo um desenvolvimento sustentável dos territórios, com o objetivo de combater o declínio económico-social e criar fatores de competitividade (Cabo *et al.*, 2020).

2.1.1 O contributo do turismo para os territórios

O turismo constitui uma das melhores atividades para valorizar os recursos endógenos (Carvalho, 2020). Consequentemente, os gestores dos destinos devem apoiar as práticas turísticas catalisadoras do desenvolvimento dos seus territórios (Ramos, 2019). Além do mais, as atividades turísticas são tendencialmente baseadas "em fatores endógenos, representativos dos locais e glorificadores dos valores e tradições próprias", que evidenciam a singularidade do destino (Ramos, 2019, p.29). Neste sentido, o desenvolvimento turístico de uma região depende das suas especificidades e da importância que lhes são conferidas nas estratégias de desenvolvimento (Carvalho, 2020; Ribeiro *et al.*, 2005).

É, pois, essencial que cada a região aposte na inovação das atividades turísticas, desenvolva parcerias estratégicas e tire proveito do potencial dos produtos endógenos, enquanto procura preservar, revitalizar, conservar e valorizar o património cultural e natural (Vareiro & Ribeiro, 2007). Além disso, o desenvolvimento turístico regional não deverá focar-se num só produto, mas sim diferenciar-se em relação a destinos concorrentes. A diversificação de produtos turísticos revela-se uma vantagem comparativa para os destinos, que leva ao aumento da sua competitividade, permitindo maior personalização das experiências e capacidade para acompanhar os desejos dos turistas (Benur & Bramwell, 2015).

2.1.2 O turismo sustentável e regenerativo como contributo para o desenvolvimento local

As comunidades locais são um dos principais intervenientes das atividades turísticas, pelo que "(…) têm de estar diretamente envolvidas na redefinição e reestruturação do desenvolvimento turístico" (Duxbury *et al.*, 2020, p.110). É muito importante que haja um contínuo envolvimento e participação dos residentes locais nos processos decisórios, na gestão sustentável dos recursos endógenos, na promoção de experiências autênticas e na preservação do património cultural (Duxbury *et al.*, 2021; Kovačić *et al.*, 2024). Além disso, quando envolvidos no planeamento e na gestão das atividades turísticas, os residentes conseguem assegurar que o desenvolvimento turístico na sua região atenda às suas necessidades e desejos (Easterling, 2004), aumentando o seu bem-estar (Rivera *et al.*, 2016, p.7).

O recente paradigma de "*turismo regenerativo*", surgido na sequência da pandemia de Covid-19, traduz-se numa reorientação das motivações e intenções dos turistas, em favor de destinos rurais e distantes das áreas urbanas. É uma mudança que pode ser "utilizada para promover a sustentabilidade local e a regeneração nas pequenas comunidades" (Duxbury *et al.*, 2021, p.15). Na perspetiva do turismo regenerativo, as atividades turísticas têm potencial para desenvolver as "competências dos locais, das comunidades e dos seus hóspedes", de forma harmoniosa e interligada (Bellato *et al.*, 2023, p.2). O crescente interesse pelo turismo rural oferece uma oportunidade única para a revalorização de patrimónios locais (Soares & Dias, 2024). Na visão do turismo regenerativo, "criam-se ligações e desenvolvem-se relações recíprocas e mutuamente benéficas através de práticas e experiências de viagem, que refletem a forma única dos locais turísticos" (Bellato *et al.*, 2023, p.17).

Turismo sustentável e turismo regenerativo são abordagens interdependentes que visam satisfazer as necessidades dos consumidores atuais, sem pôr em causa o bem-estar das futuras gerações. No entanto, a perspetiva do turismo regenerativo vai mais além: não se trata apenas de minimizar impactos negativos das atividades turísticas, mas também de criar ligações positivas entre todos os stakeholders (Bellato *et al.*, 2023), de modo a contribuir favoravelmente para a regeneração dinâmica das "comunidades, das culturas, do património, dos lugares, etc." (Duxbury *et al.*, 2021, p.3). O turismo regenerativo procura "beneficiar o todo sem prejuízo das partes" (Duxbury *et al.*, 2020, p.110), fomentando a escolha de opções mais conscientes, sustentáveis e responsáveis, que beneficiem o todo. As práticas de gestão inclusivas e participativas são fundamentais para o sucesso do turismo regenerativo. É necessário que as políticas de turismo sustentável incorporem as dimensões sociais e económicas, garantindo a inclusão das comunidades nos processos decisórios (Cordeiro & Körössy, 2018). A aplicação desses conceitos pode ser observada em diversas iniciativas que evidenciam o papel do turismo rural na promoção de desenvolvimento sustentável em interação com os stakeholders locais (Eusébio *et al*., 2014).

Atualmente, os turistas valorizam o que é autêntico, as experiências e tradições que transmitem a cultura do destino (Ramos, 2019). Para isso, a comunidade dispõe de conhecimentos exclusivos, valores e tradições, bem como de competências e bens patrimoniais únicos, que possibilitam a criação de experiências memoráveis e autênticas (Sapkota *et al*., 2024).

Em suma, o envolvimento da comunidade na tomada de decisões, no planeamento e na gestão do destino influencia favoravelmente as atitudes dos residentes, além de promover o desenvolvimento turístico sustentável (Easterling, 2004). Estes factos devem ser um incentivo aos gestores de destinos na redefinição das suas estratégias, focando-as na cooperação entre todos os stakeholders e na valorização dos recursos endógenos, promovendo e reforçando assim a identidade da sua região. A colaboração entre todos possibilita a troca de conhecimentos, uma maior divulgação da imagem do destino e a criação de sinergias que impulsionam o desenvolvimento holístico e sustentável do território (Reis *et al.*, 2024).

2.2. A aposta nos produtos endógenos como estratégia de desenvolvimento

Alguns autores definem produto endógenos como: "*aqueles que são originários da própria região, constituindo o fator de diferenciação e que podem originar em seu torno uma organização e criação de atividades e produtos turísticos*" (Nascimento *et al.*, 2014, p.36). Por seu turno, Barroco e Augusto, (2016, p.26) referem que "*os produtos endógenos, (...) são detentores de características particulares no que se refere à sua origem geográfica, à natureza das matérias-primas utilizadas na sua produção e ao uso de determinado processo particular de produção/transformação. Normalmente, são produtos sazonais e possuem características que fazem deles especiais, únicos e diferentes ao refletirem a riqueza cultural das regiões onde são produzidos*". Moura *et al.*, (2025, p.5) acrescentam que *"os produtos endógenos têm origem numa região geográfica específica e estão estreitamente relacionados aos seus recursos naturais, tradições e práticas culturais"*.

Os produtos endógenos podem ser caracterizados em função dos seguintes parâmetros: (a) origem geográfica; (b) natureza e qualidade das matérias-primas utilizadas; (c) técnicas, conhecimento e processo de produção/ transformação; (d) costumes e tradições locais característicos da região (Rodrigues, 2021; Baptista *et al.*, 2008; Gonda *et al.,* 2021). O produto endógeno é, portanto, único, diferenciador e especial, pois é capaz de aproximar e conectar o produtor, a comunidade residente e os visitantes de uma região.

De certo modo, são produtos que "refletem as características intrínsecas e distintivas do destino/território" (Turismo de Portugal, 2017, p.46), como é o caso das tradições, das técnicas e dos conhecimentos que são desenvolvidos e transmitidos ao longo de gerações entre a população local. Além disso, quanto mais estes produtos são distinguidos e promovidos, mais valorizada é a cultura e a identidade da região (Pato & Scherer, 2023). Aliás, a melhoria das condições de vida da população residente em áreas menos desenvolvidas, é impulsionada pela diversificação e utilização dos seus recursos endógenos (Jóia & Carvalho, 2012).

Quando bem geridos, os produtos endógenos possibilitam: (a) "criação e retenção de emprego"; (b) "manutenção, preservação e revitalização das tradições"; (c) "criação e exploração de um espaço rural viável"; (d) "diversificação da oferta turística" (Gonda *et al.*, 2021, p.93). Compreende-se que a criação e o usufruto dos produtos endógenos favorecem as economias regionais, criando oportunidades de negócios e fontes de rendimento da comunidade (Ramos, 2019). Adicionalmente, o consumo de produtos endógenos é benéfico para o meio ambiente, porque reduz as importações e a pegada de carbono dos transportes. Culturalmente, os produtos endógenos preservam e revitalizam as tradições, os conhecimentos e as técnicas utilizadas pela comunidade, contribuindo para a valorização da identidade local e a coesão territorial (Pato & Scherer, 2023). Numa perspetiva social, verifica-se um contributo na melhoria da qualidade de vida da comunidade local.

Para que os destinos turísticos alcancem um desenvolvimento sustentável, regenerativo e competitivo, deverá haver uma maior preocupação com a preservação dos recursos endógenos, mas também com a salvaguarda dos restantes recursos e infraestruturas de suporte (Ritchie & Crouch, 2003). Não esquecendo que, quando o consumidor escolhe produtos regionais, este facto tem um forte impacto na produção local e no apoio à sustentabilidade da população residente (Rodrigues, 2021). Um destino é bem-sucedido quando há uma combinação ótima entre satisfação dos turistas, qualidade de vida dos residentes e sustentabilidade dos recursos, no âmbito da preservação e conservação dos recursos naturais e culturais (Kovačić *et al.*, 2024).

2.3. Modos de valorização de produtos endógenos

No contexto da salvaguarda e valorização dos produtos endógenos, merecem especial destaque quatro elementos que podem ser utilizados em sinergia e/ou complementaridade: a certificação de produtos regionais, as rotas turísticas, os eventos de promoção de produtos endógenos e o turismo criativo.

A certificação dos produtos de origem representa um reconhecimento importante, tanto para o produtor como para o consumidor, da qualidade dos produtos endógenos (Duque *et al.*, 2023). Os produtos certificados além de fidelizarem os consumidores, também acrescentam "um valor intrínseco ao produto" (Duque *et al.*, 2023, p.304). Assim, o produto endógeno certificado é valorizado como um elemento-chave diferenciador e distintivo de uma região, reforçando a competitividade, bem como o desenvolvimento turístico e o marketing do destino. Os turistas procuram estes produtos, porque não só detêm uma qualidade acrescida como promovem atividades turísticas sustentáveis (Duque *et al.*, 2023), proporcionando-lhes mais satisfação e benefícios ao nível do bem-estar físico e mental (Jiang *et al.*, 2025).

As rotas turísticas são um bom instrumento de dinamização dos territórios. Os turistas têm a possibilidade, não só de conhecer e explorar as localidades, como também aprender formas de confeção tradicionais e apreciar o valor dos produtos endógenos (Barroco & Amaro, 2023). A título de exemplo, as rotas gastronómicas "permitem aos territórios promover a interação direta entre visitantes e a comunidade local, a partir de experiências e atividades relacionas com os produtos certificados" (Duque *et al.*, 2023, p.306).

Os eventos de promoção de produtos endógenos são verdadeiras atrações no mercado turístico e contribuem positivamente para a atração de visitantes. São disso exemplo os mercados de produtores locais, as feiras regionais, os festivais, as exposições de artesanato, etc. (Lee *et al.*, 2017). Ao participarem nestes eventos, os turistas vivenciam um sem-número de experiências relacionadas com a gastronomia local, as tradições, a arquitetura local, exposições de arte, etc., podendo também envolver-se em atividades criativas, como é o caso dos workshops de artesanato, arte popular, design, música, etc. (Li & Kovacs, 2022).

O turismo criativo pode ser considerado um elemento regenerativo, pois utiliza as atividades turísticas como uma ferramenta eficaz para a sustentabilidade, recuperação e bem-estar da comunidade local. O turismo criativo "contribui para a preservação do património cultural e revitaliza as artes, os ofícios e as tradições" *(*Duxbury *et al.*, 2021, p.15). Nestas iniciativas, é essencial que as comunidades estejam ativamente envolvidas no planeamento e na tomada de decisões quanto à exploração das atividades turísticas para o desenvolvimento local, preservação do património e promoção cultural (Duxbury *et al.*, 2021).

3. DESENVOLVIMENTO TURÍSTICO EM TERRITÓRIOS DE BAIXA DENSIDADE

O conceito de TBD ainda não tem muita fundamentação teórica. Aliás, em Portugal, não existe uma definição legal para esta noção. A Comissão Interministerial de Coordenação do Portugal 2030 (2023), distingue TBD com base em dois critérios: (a) a densidade populacional - relação entre o número de habitantes de uma determinada área territorial e a sua respetiva superfície, em quilómetro quadrado (INE, 2003), e (b) o rendimento per capita de cada concelho.

Segundo o programa Portugal 2020 (Deliberação nº55/2015) foi adotado um procedimento multicritério "que considera a densidade populacional, a demografia, o povoamento, as características físicas do território, as características socioeconómicas e as acessibilidades" para avaliar quais são os municípios de BD (Comissão Interministerial de Coordenação do Portugal 2020, 2015, p.1).

Em Portugal Continental, os destinos do litoral (o Algarve, as áreas metropolitanas de Lisboa e Porto e faixa costeira ocidental), são as principais áreas de captação turística, onde o turismo já se encontra bastante desenvolvido (Reis & Baltazar, 2019). No polo oposto, a maioria dos municípios do interior estão em TBD, caracteristicamente de perfil rural e/ou de montanha e baixo nível de desenvolvimento turístico (Rei & Baltazar, 2019), sofrendo de crónico despovoamento e envelhecimento da população, e de reduzidos rendimentos e níveis de educação (Reis & Baltazar, 2019; Carneiro & Eusébio, 2015). Acredita-se que a aposta em novos serviços e produtos turísticos de valor pode oferecer a estes territórios a oportunidade de progredirem de forma sustentável. Reconhece-se que, no interior, a oferta e a procura turística têm uma insuficiente articulação e organização, embora se verifiquem esforços conjuntos para a integração destes territórios em estratégias e programas de desenvolvimento territorial (Reis & Baltazar, 2019). Tendo em consideração algumas das limitações de desenvolvimento dos TBD, o turismo é entendido como instrumento de coesão territorial, isto é, um veículo para incentivar a população à permanência (Reis & Baltazar, 2019), para gerar mais empregos e receitas (Benaraba *et al.*, 2022), para reduzir desigualdades de rendimentos e para combater a pobreza (Zhang *et al.*, 2023), estimulando a expansão de outras atividades socioeconómicas (Khan *et al.*, 2020) e de melhoria da qualidade de vida da comunidade local (Carneiro & Eusébio, 2015). As atividades turísticas nos TBD impulsionam a valorização do património local (natural ou construído) e invocam uma visão de sustentabilidade e conservação, propiciando experiências turísticas personalizadas de valor acrescentado com base em estratégias que envolvem todos os stakeholders (Silva & Lopes, 2020).

3.1. Contexto na região Centro de Portugal

A região Centro de Portugal é constituída por 8 sub-regiões (Região de Aveiro, Região de Coimbra, Região de Leiria, Viseu Dão Lafões, Beira Baixa, Beiras e Serra da Estrela, Oeste e Médio Tejo) e por um total de 100 municípios (Figura 1) (Observatório do Turismo Sustentável do Centro de Portugal, 2025).

Figura 1. Sub-regiões da região Centro de Portugal

Fonte: Accessible Portugal, 2024

No programa Portugal 2030 (Deliberação n.º 31/2023/PL), foram utilizadas as mesmas diretrizes do Programa 2020. Em resultado, foram identificados um total de 165 municípios em TBD, dos quais 60 pertencem à região Centro, além de 20 freguesias de BD que estão integradas em 7 municípios de Alta Densidade (AD) da região Centro (Quadro 1). Constata-se que as Comunidades Intermunicipais (CIM) da Beira Baixa e Beiras e Serra da Estrela têm todos os seus concelhos com BD. A Região Viseu Dão Lafões está numa situação semelhante, com exceção do município de Viseu que é de AD. Dos 19 concelhos da Região de Coimbra, mais de metade (12) têm BD. A Região de Leiria tem pelo menos 5 municípios de BD. A CIM Médio Tejo tem um total de 11 concelhos, dos quais 6 são de BD. A Região Oeste não tem qualquer município de BD, demonstrando assim um forte posicionamento do número de população residente no território da região. A Região de Aveiro surge também com uma distribuição uniforme de concelhos com AD, sendo Sever do Vouga o único concelho de BD.

Quadro 1: Territórios de Baixa Densidade da região Centro

<table>
<tr><th>CIM</th><th colspan="2">CIM com todos os seus municípios em territórios BD</th></tr>
<tr><td>Beira Baixa (8)</td><td colspan="2">Castelo Branco; Idanha-a-Nova; Oleiros; Penamacor; Proença-a-Nova; Sertã; Vila de Rei; Vila Velha de Ródão</td></tr>
<tr><td>Beiras e Serra da Estrela (15)</td><td colspan="2">Almeida; Belmonte; Celorico da Beira; Covilhã; Figueira de Castelo Rodrigo; Fornos de Algodres; Fundão; Gouveia; Guarda; Manteigas; Mêda; Pinhel; Sabugal; Seia; Trancoso</td></tr>
<tr><td>CIM</td><td>Municípios de BD</td><td>Freguesias BD em municípios de AD</td></tr>
<tr><td>Médio Tejo (6)</td><td>Abrantes; Constância; Ferreira do Zêzere; Mação; Sardoal; Vila Nova da Barquinha</td><td>Ourém: Espite; U. F. Freixianda, R. Fárrio e Formigais; U. F. Matas/Cercal; U. F. Rio de Couros/Casal dos Bernardos; Tomar: Olalhas; Sabacheira; U. F. Além da Ribeira e Pedreira; U. F. Casais e Alviobeira; U. F.de Serra e Junceira</td></tr>
<tr><td>Região de Aveiro (1)</td><td>Sever do Vouga</td><td>Águeda: U.F. Belazaima do Chão, Castanheira de Vouga e Agadão; U. F. Préstimo e Macieira de Alcoba</td></tr>
<tr><td>Região de Coimbra (12)</td><td>Arganil; Góis; Lousã; Miranda do Corvo; Mortágua; Oliveira do Hospital; Pampilhosa da Serra; Penacova; Penela; Soure; Tábua; Vila Nova de Poiares</td><td>Condeixa-a-Nova: Furadouro</td></tr>
<tr><td>Região de Leiria (5)</td><td>Alvaiázere; Ansião; Castanheira de Pêra; Figueiró dos Vinhos; Pedrógão Grande</td><td>Pombal: Abiul
Porto de Mós: São Bento</td></tr>
<tr><td>Viseu Dão Lafões (13)</td><td>Aguiar da Beira; Carregal do Sal; Castro Daire; Mangualde; Nelas; Oliveira de Frades; Penalva do Castelo; Santa Comba Dão; São Pedro do Sul; Sátão; Tondela; Vila Nova de Paiva; Vouzela</td><td>Viseu: Calde; Cavernães; Cota; Ribafeita; S. Pedro de France; U. F. Barreiros e Cepões</td></tr>
</table>

Segundo o Relatório Anual de Progresso 2023 do Observatório do Turismo Sustentável do Centro de Portugal, verifica-se que o número de dormidas em 2023, nas CIMs com municípios de BD foi mais reduzido, como por exemplo na Beira Baixa (290 450 dormidas) e Viseu Dão Lafões (571 355 dormidas). Já nas CIMs com municípios de AD ocorreram mais dormidas, nomeadamente no Oeste

(1 606 783 dormidas) e na Região de Aveiro (928 445 dormidas). A tendência é semelhante para o indicador taxa de ocupação por cama, que foi relativamente mais reduzido nas sub-regiões com municípios de BD, como foram os casos da Beira Baixa (30.10%), Beiras e Serra da Estrela (28.40%) e de Viseu Dão Lafões (24.90%). Em contraste, a maior taxa de ocupação-por cama foi registado nas CIMs com mais municípios de AD, designadamente a Região de Aveiro (41.20%) e o Oeste (37%). Portanto, constata-se que as atividades turísticas têm sido implementadas de forma diferente entre os municípios de AD e os de BD na região Centro (Turismo Centro de Portugal, 2025).

A partir da revisão de literatura, identificou-se escassa investigação em relação ao estudo comparativo das perspetivas dos residentes de TBD e os de TAD quanto ao desenvolvimento turístico da sua localidade. Portanto, por um lado, são necessários mais estudos empíricos para descobrir os pontos de vista dos residentes das comunidades de BD, tendo em conta que estes habitam em áreas que têm exigido mais investimentos e desenvolvimentos turísticos. Por outro lado, é relevante apurar as apreciações e avaliações dos residentes de TAD, uma vez que ao viverem em áreas mais urbanas lidam mais diretamente com a crescente pressão das atividades turísticas (Stevic *et al*., 2024). Com base no exposto, foram formuladas as seguintes hipóteses:

H1: Na região Centro, os inquiridos dos TBD atribuem ponderações mais favoráveis aos impactos positivos do turismo do que os inquiridos dos TAD.

H2: Na região Centro, os inquiridos dos TAD são mais sensíveis e preocupados (atribuem ponderações mais elevadas) com os impactos negativos do turismo na sua região do que os inquiridos dos TBD.

H3: Na região Centro, os inquiridos dos TBD atribuem ponderações mais elevadas à aposta das entidades responsáveis em prol de um turismo mais sustentável e regenerativo comparativamente aos inquiridos dos TAD.

4. METODOLOGIA

O presente estudo visa comparar e compreender as diferenças de perspetiva entre residentes de TAD e de TBD do Centro de Portugal, em relação ao desenvolvimento turístico, tendo por base a valorização dos seus produtos endógenos. Com esta análise, pretende-se averiguar se, de facto, os inquiridos dos TBD consideram que o turismo contribui a comunidade local e se é adequado na promoção regional.

Os dados empíricos do presente estudo foram obtidos no âmbito do estudo anual “O Turismo na Perspetiva dos Residentes - Centro de Portugal 2024”, realizado pelo Observatório do Turismo Sustentável do Centro de Portugal (OTSCP). Tratou-se de um inquérito *online*, com recurso à plataforma *Google Forms* e divulgado por correio eletrónico às 972 freguesias dos 100 municípios da região e, paralelamente, promovido nas redes sociais e por via de publicações da imprensa. A recolha de dados decorreu entre os dias 12 de novembro e 11 de dezembro de 2024.

A primeira secção visava aferir, de uma maneira global, o quão benéfico ou prejudicial é para o respondente o turismo na sua região, avaliando 7 domínios (Qualidade de Vida, Património Cultural, Património Natural, Identidade Regional, Cultura Regional, Preservação do Ambiente e Economia Regional), através de uma escala de Likert de 5 pontos, sendo 1 “Muito Prejudicial” e 5 “Muito Benéfico”.

Na segunda secção, encontram-se listas de afirmações categóricas (a serem avaliadas de 1 a 5, entre “discordo totalmente” e “concordo totalmente”) que visam aferir a perceção dos residentes da região Centro em relação a diversos dos impactos do turismo, e respetivos benefícios ou contributos para o desenvolvimento regional e local. Na segunda secção, as afirmações a avaliar incidem sobre as atitudes dos residentes em relação aos benefícios percebidos e impactos positivos mais evidentes a senso comum do turismo na região (ver itens incluídos no Quadro 3). Adicionalmente, esta lista de afirmações incluía referências a eventuais impactos negativos para a região (ver itens no Quadro 3).

Na terceira secção, pretendia-se que os inquiridos indicassem o seu nível de concordância *versus* discordância em relação a 13 afirmações sobre o eventual papel do turismo no desenvolvimento turístico sustentável e regenerativo regional. As temáticas associadas às afirmações abrangiam temas como indústrias criativas, valorização da identidade, preservação ambiental e cultural, promoção do bem-estar, rotas turísticas, certificação de produtos, entre outras (ver lista de itens no Quadro 3).

Por último, no questionário eram solicitados os dados relativos ao inquirido, designadamente género, idade, estado civil, nível de escolaridade, concelho e freguesia de residência, bem como se dispõe de uma segunda habitação. Adicionalmente, solicitou-se a indicação da relação da atividade profissional do inquirido com o setor turístico, isto é, se há uma relação nula, parcial ou plena.

Os resultados do inquérito foram submetidos a uma análise quantitativa, com o auxílio do *Software* IBM SPSS Statistics. As 34 escalas de Liket foram transformadas em 5 fatores, através da análise fatorial em componentes principais. Em seguida, procedeu-se à análise de diferenças de média desses 5 fatores em função de duas variáveis: dependência profissional dos inquiridos ao turismo e residência dos inquiridos em TAD ou TBD. Nos testes de hipóteses considerou-se um nível de confiança igual ou superior de 95% na refutação da hipótese nula (sig. ≤ a 0.05 ou 5%).

4.1. Caracterização sociodemográfica da amostra

Das 435 respostas registadas, foram consideradas válidas 418, dado que 17 eram provenientes de residentes que não residem na região Centro. Os inquiridos das comunidades intermunicipais de Coimbra, Leiria e Oeste (isto é três da 4 sub-regiões costeiras de AD) foram os que mais contribuíram, representando cerca de 51.2% das respostas ao questionário. Em contraste, observou-se menor adesão por parte dos residentes das regiões da Beira Baixa, Viseu Dão Lafões e da Região de Aveiro, registando-se apenas 112 respostas.

Através da indicação do concelho e da freguesia, foi possível verificar que foram fornecidas 174 (42%) respostas por parte de inquiridos de TBD e 244 (58%) de TAD, sendo que a maioria dos municípios da região Centro com BD encontram-se nas sub-regiões da Beira Baixa, Beiras e da Serra da Estrela e de Viseu Dão Lafões.

No Quadro 2, observa-se uma distribuição equilibrada entre os respondentes do sexo feminino e do sexo masculino. Quanto aos níveis de habilitações, há uma predominância de inquiridos com o Secundário e a Licenciatura. A distribuição etária dos inquiridos encontra-se maioritariamente entre os 41 e os 60 anos e, com uma participação mais escassa de respondentes com idades entre os 19 e os 30 anos. Em relação ao estado civil, contata-se que cerca de 64.4% dos inquiridos são casados ou em união de facto e solteiros são 24.4%. A dependência ao turismo é sobretudo nula (62.4%), demostrando assim que a maior parte dos inquiridos tem um emprego sem relação com o turismo. Apenas 10.8% afirmou que a sua atividade profissional depende diretamente do turismo. Relativamente, à propriedade de uma segunda habitação, mais de 80% respondeu negativamente, sendo que apenas 76 respondentes são proprietários de 2ª habitação.

Considerando a especificidade do método de recolha de dados, a amostra, apesar de muito diversificada, não pode ser considerada como representativa da população residente na região Centro, sendo uma amostra de conveniência. O estudo foi sujeito à delimitação geográfica (Centro de Portugal) e foi de participação voluntária, ou seja, não houve controlo sobre quem respondeu ao inquérito, uma vez que apenas participaram aqueles que estavam disponíveis e com interesse no tema. A opção por esta metodologia é justificada pelo contexto e pelas limitações de recursos, tempo e contacto direto com a população-alvo.

Quadro 2: Caraterização sociodemográfica da amostra (N = 418)

Género:	**N**	**%**	**Escolaridade:**	**N**	**%**
Masculino	198	47,4	Básico	16	3,8
Feminino	218	52,1	Secundário	140	33,5
Não Binário	2	00,5	Licenciatura	162	38,8
Escalão etário:	**N**	**%**	Mestrado	77	18,4
19 a 30 anos	32	7,7	Doutoramento	23	5,5
31 a 40 anos	75	17,9	**Possui 2ª habitação?**	**N**	**%**
41 a 50 anos	134	32,1	Não	342	81,8
51 a 60 anos	102	24,4	Sim	76	18,2
Mais de 60 anos	75	17,9	**Dependência ao turismo:**	**N**	**%**
Estado civil:	**N**	**%**	Nula	261	62,4
Solteiro(a)	102	24,4	Parcial	112	26,8
Casado / U. de facto	269	64,4	Plena	45	10,8
Viúvo(a)	8	1,9	**Território onde reside**	**N**	**%**
Divorciado(a)	39	9,3	Alta densidade	244	58,4
			Baixa densidade	174	41,6

5. RESULTADOS E DISCUSSÃO

5.1. Análise Fatorial em componentes principais

Através da aplicação da Análise Fatorial em Componentes Principais, foram obtidos cinco fatores que apresentam nível elevado de confiabilidade (valores de Alpha de Cronbach entre 0.87 e 0.96) (Quadro 3). O modelo fatorial obtido explica 72.2% da variância total. O Teste de Kaiser-Meyer-Olkin (0.96) e o teste de esfericidade de Bartlet (p <0.001) garantem que os dados deste estudo são adequados à análise fatorial.

Quadro 3: Análise fatorial em componentes principais (AFCP)

Fatores	Peso	Média
Fator 1: Aposta no turismo sustentável e regenerativo (variância explicada: 50,90%; α= 0,96) "Na minha região, o Turismo…	**17,31**	**2,94**
… promove rotas turísticas"	0,77	3,19
… promove as indústrias criativas	0,64	3,17
… valoriza práticas culturais (identidade local)	0,73	3,14
… aposta na autenticidade	0,65	3,07
… promove o bem-estar dos turistas	0,74	3,06
… promove a Inovação e diversificação de Produtos	0,81	3,05
… promove a certificação de produtos de origem regional	0,76	2,98
… aposta na preservação garantir a sustentabilidade	0,55	2,90
… consciencializa para a preservação ambiental e cultural	0,72	2,86
… promove a resiliência económica	0,69	2,76
… promove a exploração responsável dos recursos	0,64	2,75
… aposta na redução de desequilíbrios regionais	0,64	2,66
… Envolve a comunidade local no planeamento	0,56	2,41
"Sinto-me satisfeito(a) com o turismo na região"	0,48	3,20
Fator 2: Impactos positivos globais do Turismo (variância explicada: 10,43%; α = 0,95) *"Na minha região o turismo tem impactos positivos…*	**3,55**	**3,56**
... no património cultural"	0,75	3,84
... na cultura regional"	0,81	3,73
... identidade regional"	0,80	3,65
... no património natural"	0,77	3,47
... na qualidade de vida"	0,70	3,47
...na preservação do ambiente"	0,71	3,21
Fator 3: Benefícios percebidos do turismo (variância explicada: 5,95%; α = 0,92) *"Na minha região o turismo…*	**2,02**	**3,74**
... é benéfico para a economia"	0,56	4,10
... contribui para a melhoria da economia local"	0,75	3,86
... cria oportunidades de emprego"	0,79	3,81
... é benéfico para a comunidade local"	0,59	3,81
... diversifica as opções de lazer e experiências culturais"	0,52	3,49
... é benéfico para mim"	0,54	3,13
Fator 4: Impactos negativos mais evidentes ao senso comum (variância: 3,52%; α = 0,90) *"Na minha região o turismo aumenta …*	**1,20**	**3,07**
... o custo de vida"	0,79	3,62
... os desperdícios e resíduos"	0,84	3,28
... a superlotação dos espaços locais"	0,88	3,06
... a poluição visual e sonora"	0,88	2,97
... o sentimento de insegurança e vandalismo"	0,77	2,45
Fator 5: Impactos positivos mais evidentes ao senso comum (variância: 3,05%; α =0,87) *"Na minha região o turismo contribui para a…*	**1,04**	**3,08**
... requalificação de edifícios e para o planeamento urbano"	0,50	3,25
... preservação e conservação de espaços naturais"	0,60	3,11
... melhoria das infraestruturas (água, saneamento, elet., transp., comunicações)	0,59	2,89

5.2. Influência do perfil sociodemográfico na avaliação dos impactos e benefícios do turismo na região Centro

O perfil sociodemográfico foi delineado a partir de seis variáveis: Género, Idade, Estado Civil, Escolaridade, Dependência Profissional ao Turismo e Local de Residência (Sub-região). No presente estudo não foram estabelecidas hipóteses sobre o efeito das variáveis sociodemográficas na avaliação dos impactos percebidos do turismo. No entanto, um estudo recente, sobre a satisfação dos residentes e impactos percebidos do turismo na região Centro (Dias *et al.*, 2024), revelou que a variável "dependência profissional ao turismo" influencia as perceções e atitudes dos residentes: aqueles que exercem cargos profissionais ligados à atividade turística avaliam mais positivamente os impactos do turismo, do que os inquiridos que não dependem profissionalmente do turismo, como decorre da teoria das trocas sociais (Andereck *et al.*, 2005). Ora, no presente estudo, esta hipótese é também corroborada: os inquiridos cujas profissões estão diretamente ligadas ao turismo atribuem ponderações mais positivas aos fatores "Aposta no turismo sustentável e regenerativo", "Impactos positivos globais do turismo" e "Benefícios percebidos do turismo" do que os inquiridos cujas profissões não dependem do turismo (ver Quadro 4).

Quadro 4: Efeitos da variável "dependência profissional ao turismo"

Fatores	Média global	Dependência profissional ao turismo			Significância	
		Nula (n=261)	Parcial (n=112)	Total (n=45)	F	Sig.
Aposta no Turismo sustentável e regenerativo	2,96	2,83	3,16	3,23	7,58	0,001
Impactos positivos globais do turismo	3,60	3,47	3,77	3,85	5,12	0,006
Benefícios percebidos do turismo	3,76	3,57	4,06	4,18	15,63	0,001
Impactos negativos mais evidentes ao senso comum	3,05	3,08	3.03	2,98	0,21	0,809
Impactos positivos mais evidentes ao senso comum	3,02	3,05	2,99	2,92	0,31	0,734

Verificou-se que as variáveis "género", "idade" e "estado civil" não têm quaisquer efeitos significativos na avaliação dos cinco fatores que integram o presente estudo. Contudo a variável "escolaridade" teve influência na avaliação de três dos cinco fatores: "Aposta no turismo Sustentável e regenerativo", "Impactos positivos globais do Turismo" e "Benefícios percebidos do turismo". Os inquiridos com menores níveis de escolaridade (básico e secundário) avaliam os impactos do turismo de modo mais positivo do que os inquiridos com mestrado e doutoramento.

5.3. Avaliação comparativa da perceção dos impactos do turismo pelos residentes de territórios de alta e baixa densidade

Considerando a avaliação individual de cada um dos seis itens que integram a dimensão "Impactos positivos globais do Turismo" (ver Quadro 5), constata-se que as médias de avaliação dos inquiridos são positivas em todas as seis sub-dimensões, com valores sempre acima de 3 (ponto médio das escalas que variam entre 1 = "Muito Prejudicial" e 5 "Muito Benéfico"). A sub-dimensão que apresenta melhor performance é a do "património cultural". Curiosamente, é apenas nesta sub-dimensão que o local de residência não tem efeitos significativos na avaliação dos inquiridos (3.81 para "alta densidade" *versus* 3.96 para "baixa densidade"; t =1.48; p = 0.140). Nas restantes cinco sub-dimensões (cultura regional, identidade regional, património natural, qualidade de vida e preservação do ambiente) os inquiridos de TBD avaliam mais positivamente o turismo, em conformidade com a Hipótese 1 deste estudo.

Quadro 5: Efeitos da variável "densidade populacional" na avaliação do construto "Impactos positivos globais do turismo"

Escalas *"Na minha região, o Turismo tem impactos positivos…*	Alta Densidade (n = 244)		Baixa Densidade (n = 174)		Significância	
	Média	D.P	Média	D.P	t	p
…no património cultural"	3,81	1,01	3,96	1,01	1,48	0,140
…na cultura regional"	3,65	1,13	3,93	1,01	2,59	0,010
… na identidade regional"	3,56	1,19	3,86	1,04	2,72	0,007
…no património natural"	3,33	1,20	3,74	1,17	3,42	0,001
…na qualidade de vida"	3,36	1,13	3,70	1,09	3,08	0,002
…na preservação do ambiente"	3,03	1,18	3,54	1,17	4,38	0,001
Impactos positivos globais do Turismo	3,46	0,99	3,79	0,99	6,85	0,001

Em relação à avaliação da dimensão "Benefícios percebidos no Turismo", não se observa qualquer efeito da variável "densidade populacional" (Quadro 6). Em cinco das seis sub-dimensões consideradas, não se observam diferenças de média estatisticamente significativas entre as duas amostras de inquiridos. A exceção diz respeito à sub-dimensão "Na minha região, o Turismo é benéfico para mim", cuja média das avaliações dos inquiridos de TBD é significativamente superior (respetivamente, 3.36 versus 3.02, t = 2.54; p =0.012).

É interessante constatar que as duas sub-dimensões com melhor performance são os benefícios da área económica: "impactos positivos na economia" e "contributo para a melhoria da economia local". Em contraste, é a sub-dimensão "… o Turismo é benéfico para mim", a que apresenta níveis menos favoráveis de concordância dos inquiridos. Neste mesmo ranking, as sub-dimensões dos domínios socioeconómico ("oportunidades de emprego) e sociocultural ("benefício para a comunidade local" e "diversificação das opções de lazer e culturais") ocupam posições intermédias. Ou seja, para os inquiridos de ambos os territórios, o turismo tem elevada performance na área económica, performance moderada na área sociocultural, e performance relativamente baixa no domínio pessoal, especialmente, neste último caso, na perspetiva dos inquiridos de TAD, onde o turismo está mais desenvolvido.

Quadro 6: Efeitos da variável "densidade populacional" na avaliação do construto "Benefícios percebidos do turismo"

Escalas *"Na minha região, o Turismo...*	**Alta Densidade (n = 244)**		**Baixa Densidade (n = 174)**		**Significância**	
	Média	**D.P**	**Média**	**D.P**	**t**	**p**
... é benéfico para a economia"	4,14	0,90	4,07	1,03	0,70	0,485
... contribui para a melhoria da economia local"	3,90	1,11	3,86	1,26	0,39	0,697
... cria oportunidades de emprego"	3,91	1,10	3,72	1,28	1,62	0,105
... é benéfico para a comunidade local"	3,78	1,15	3,91	1,23	1,11	0,265
... diversifica as opções de lazer e experiências culturais"	3,45	1,18	3,60	1,23	1,24	0,214
... é benéfico para mim"	3,02	1,37	3,36	1,33	2,54	0,012
Benefícios percebidos do turismo	3,75	0,94	3,78	1,09	0,34	0,733

Relativamente à dimensão "Impactos negativos mais evidentes ao senso comum" (Quadro 7), constata-se que os inquiridos de TBD revelam níveis de apreensão (avaliações médias) mais baixos do que os de TAD, em 4 das 5 sub-dimensões deste construto. Comparando as cinco sub-dimensões, apenas a do "aumento do custo de vida" obteve um nível de apreensão superior ao ponto médio da escala na sub-amostra de BD. Ou seja, de maior concordância de que o turismo impulsiona o aumento do custo de vida. No entanto, a sub-amostra de AD atribui a esta mesma sub-dimensão uma avaliação média comparativamente muito superior (3.95 versus 3.13; t = 7.23, p < 0.001). De resto, aos olhos dos inquiridos dos TAD (comparativamente aos inquiridos dos TBD), todas as cinco sub-dimensões de avaliação dos impactos negativos do turismo assumem maior preocupação, o que era expectável à luz da Hipótese 2, pois trata-se de territórios onde o turismo assume níveis de intensidade mais elevados. Como são frequentemente territórios onde o turismo assume maior amplitude, onde se sentem impactos de "sobrecarga, deterioração, congestionamento e perda de qualidade de vida para os residentes", é expectável existir maior descontentamento por parte das comunidades de TAD que estão a lidar no seu quotidiano com as atividades turísticas (Moleiro, Carneiro & Breda, 2021, p.926).

Quadro 7: Efeitos da variável "densidade populacional" na avaliação do construto "Impactos negativos mais evidentes ao senso comum"

Escalas *"Na minha região, o Turismo aumenta…*	**Alta Densidade (n = 244)**		**Baixa Densidade (n = 174)**		**Significância**	
	Média	**D.P**	**Média**	**D.P**	**t**	**p**
... o custo de vida"	3,95	1,13	3,13	1,16	7,23	0,000
... os desperdícios e resíduos"	3,56	1,21	2,84	1,19	5,98	0,000
... a superlotação dos espaços locais"	3,39	1,35	2,54	1,20	6,60	0,000
... a poluição visual e sonora"	3,26	1,30	2,49	1,17	6,29	0,000
... o sentimento de insegurança e vandalismo"	2,55	1,28	2,24	1,11	2,59	0,010
Impactos negativos mais evidentes ao senso comum	3,34	1,06	2,65	0,96	6,85	0,000

Quando à dimensão "Impactos positivos mais evidentes ao senso comum" (Quadro 8), os inquiridos das duas sub-amostras manifestam um nível de concordância similar em relação à sub-dimensão "contributo do turismo para a requalificação de edifícios e para o planeamento urbano". Em contrapartida, as duas sub-amostras diferem na avaliação das sub-dimensões dos impactos positivos "para a preservação e conservação dos espaços naturais" e na "melhoria das infraestruturas", com avaliações francamente mais positivas por parte dos inquiridos de TBD. Em resultado, a avaliação média nesta dimensão é também superior na sub-amostra de BD, como era expectável nos termos da Hipótese 1.

Quadro 8: Efeitos da variável "densidade populacional" na avaliação do construto "Impactos positivos mais evidentes ao senso comum"

Escalas *"Na minha região, o Turismo…*	**Alta Densidade (n = 244)**		**Baixa Densidade (n = 174)**		**Significância**	
	Média	**D.P**	**Média**	**D.P**	**t**	**p**
… contribui para a requalificação de edifícios e para o planeamento urbano"	3,26	1,23	3,28	1,31	0,11	0,914
… contribui para a preservação e conservação de espaços naturais"	2,95	1,22	3,39	1,24	3,61	0,001
… contribui para a melhoria das infraestruturas"	2,74	1,24	3,12	1,29	3,03	0,003
Impactos positivos mais evidentes ao senso comum	2,99	1,06	3,26	1,19	2,51	0,012

Como se evidencia no Quadro 9, em nenhuma das 14 sub-dimensões do construto "aposta no turismo sustentável e regenerativo" se observam avaliações mais favoráveis por parte da sub-amostra de AD. Ao invés, em 8 das 14 sub-dimensões, os inquiridos da sub-amostra de BD atribuem ponderações mais elevadas.

O conjunto das 8 sub-dimensões com melhor ponderação nos TBD ($p < 0.05$) permite esboçar um quadro interpretativo das expectativas dos residentes desses territórios quanto aos benefícios do turismo em matéria de desenvolvimento local e regional. Assim, à luz dos dados patentes no Quadro 9, pode-se afirmar que nos territórios que mais apostam no turismo para o seu desenvolvimento também lhe reconhecem maiores benefícios nos seguintes domínios (por ordem de importância de médias: (1) desenvolvimento de rotas turísticas; (2) autenticidade; (3) exploração responsável dos recursos; (4) preservação ambiental e cultural; (5) sustentabilidade; (6) resiliência económica; (7) redução de desequilíbrios regionais; (8) planeamento participativo. Estes dados corroboram a Hipótese 3. Assim constata-se que os residentes de destinos localizados em TBD vão ao encontro da perspetiva de que o turismo é determinante e favorece na revitalização do património e na preservação dos costumes locais, surgindo assim como uma oportunidade de caráter social e cultural (Moleiro, Carneiro & Breda, 2021).

Quadro 9: Efeitos da variável "densidade populacional" na avaliação do construto "Aposta no turismo sustentável e regenerativo"

Escalas *"Na minha região, o Turismo…*	**Densidade populacional**		**Significância**	
	Alta	**Baixa**		
	Média	**Média**	**t**	**p**
… promove rotas turísticas"	3,08	3,37	2,72	0,007
… promove as indústrias criativas"	3,16	3,21	0,47	0,638
… valoriza práticas culturais (identidade local)"	3,11	3,22	0,96	0,337
… aposta na autenticidade"	2,98	3,25	2,40	0,017
… promove o bem-estar dos turistas"	3,01	3,18	1,53	0,127
… promove a Inovação e diversificação de Produtos"	3,01	3,11	0,85	0,398
… promove a certificação de produtos de origem regional"	2,97	3,07	0,92	0,358
… aposta na preservação garantir a sustentabilidade"	2,63	2,98	3,00	0,002
… consciencializa para a preservação ambiental e cultural"	2,77	3,02	2,23	0,026
… promove a resiliência económica"	2,66	2,93	2,44	0,015
… promove a exploração responsável dos recursos"	2,76	3,13	3,00	0,003
… aposta na redução de desequilíbrios regionais"	2,50	2,92	3,60	<0,001
… Envolve a comunidade local no planeamento"	2,31	2,59	2,61	0,009
"Sinto-me satisfeito(a) com o turismo na região"	3,25	3,21	0,41	0,682
Aposta no turismo sustentável e regenerativo	2,87	3,09	2,38	0,018

6. CONCLUSÃO

Este estudo analisou as perspetivas dos residentes do Centro de Portugal em relação ao turismo, mais concretamente verificou a posição dos residentes dos municípios de alta e baixa densidade quanto aos benefícios, impactos e contributos do turismo. Ao analisar os dados obtidos constatou-se uma diferença de opiniões entre os inquiridos de TBD e os de TAD. Quem pertence aos TBD evidencia uma posição positiva em relação aos impactos do turismo sobre o seu quotidiano. Os mesmos defendem que o turismo incide positivamente sobre a cultura, a identidade, o património natural, na qualidade de vida e preservação do ambiente. A perspetiva destes residentes de localidades de BD é de que o "O Turismo é benéfico para mim". Esta perspetiva é crucial, pois são os principais stakeholders que diretamente são afetados na vida quotidiana pelas atividades turísticas (Kovačić *et al.*, 2024).

É no destino que os residentes interagem enquanto comunidade, que usufruem dos recursos naturais, dos serviços e das ofertas culturais para o seu bem-estar (Kovačić *et al*., 2024). Desta forma, é importante entender que quem reside nos territórios menos povoados e com reduzido número de serviços, concordou que o turismo contribui eficazmente para a melhoria das infraestruturas locais e para a conservação dos espaços naturais.

Nas afirmações relacionadas com o Turismo Regenerativo e Sustentável, os inquiridos de TBD destacaram as dimensões das Rotas Turísticas, da Autenticidade, da Sustentabilidade, da Preservação Ambiental e Cultural, da Persistência Económica, da Exploração Responsável, da Redução de Desequilíbrios Regionais e do Planeamento. Assim, constata-se que defendem o papel do turismo como indústria que: aposta na valorização dos recursos endógenos através das rotas turísticas; aposta na autenticidade, através de experiências focadas na cultura, tradições e estilo de vida local; foco na preservação dos recursos naturais e culturais, garantindo a sua sustentabilidade; conscientiza sobre a importância da preservação ambiental/cultural; revela capacidade para se adaptar a crises e diversificar as fontes de rendimento da comunidade; promove o uso responsável dos recursos, educando os visitantes sobre a conservação ambiental; contribui para reduzir desequilíbrios regionais em favor das áreas rurais, menos desenvolvidas; envolve a comunidade local diretamente no planeamento.

Quem reside em TAD deu respostas mais expressivas nos itens relacionados com os impactos negativos do turismo. Observa-se que quem vive em grandes meios urbanos tem uma perspetiva menos favorável das atividades turísticas. Estes residentes evidenciaram que o turismo tem aumentado o custo de vida, os desperdícios e os resíduos, a superlotação dos espaços locais, a poluição sonora e o sentimento de insegurança.

É através do turismo e da participação dos agentes locais que as regiões de BD têm mais oportunidades de aumentar a sua economia (Reis *et al.*, 2024). Os residentes são stakeholders "inerente e profundamente empenhados", por isso as suas perspetivas têm de ser tomadas em consideração (Kovačić *et al.,* 2024, p.2). O papel dos residentes é crucial para a competitividade do destino, embora ignorado e por vezes subestimado por intervenientes da área. No entanto, torna-se claro que estes têm potencial para impulsionar a atratividade do destino e impacto sobre "a atmosfera do destino" (Kovačić *et al.,* 2024, p.3-4). Os turistas, enquanto consumidores finais dos produtos turísticos, avaliam as experiências vividas, especialmente as mais memoráveis e autênticas, proporcionadas pelas interações sociais com a comunidade local.

O presente estudo empírico tem como limitação o facto de usar uma amostra de conveniência e, além disso, apenas compara de forma muito global e generalizada as diferenças de perceção dos residentes de TBD e TAD da região Centro, sem atender às diferenças específicas em termos de modos de vida e de condições de desenvolvimento turístico de cada comunidade. Ou seja, os respondentes são categorizados em duas categorias gerais, utilizando um elemento diferenciador do território – a "densidade populacional" – como fator explicativo das diferenças de atitudes dos residentes em relação ao desenvolvimento turístico. Não obstante as referidas diferenças de perceção e atitude dos residentes face ao turismo estarem plausivelmente ancoradas na variável demográfica, o presente estudo não explorou outras fatores que, necessariamente, interferem na mundividência dos inquiridos.

Assim, como recomendações para estudos posteriores neste domínio, sugere-se a inventariação de outros fatores que, de acordo com a literatura, podem influenciar as atitudes dos residentes, designadamente: o conceito de vinculação ao lugar (*community attachment theory*), o pendor ecocêntrico *versus* antropocêntrico dos residentes (escala NEP-New Ecological Paradigm), bem como o conjunto de fatores que determinam os benefícios percebidos do turismo e que são preconizados pela teoria das trocas sociais (*social exchange theory*).

REFERÊNCIAS BIBLIOGRÁFICAS

Accessible Portugal (2024). *AccessTUR.* Consultado em 10 de outubro de 2025, de https://accessibleportugal.com/projetos/accesstur/

Andereck, K. L., Valentine, K. M., Knopf, R. C., & Vogt, C. A. (2005). Residents' perceptions of community tourism impacts. *Annals of Tourism Research*, *32*(4), 1056–1076. https://doi.org/10.1016/j.annals.2005.03.001

Ascani, A., Crescenzi, R., & Iammarino, S. (2012). *Regional Economic Development: A Review*. Universidad de Barcelona. http://www.ub.edu/searchproject/wp-content/uploads/2012/02/WP-1.3.pdf

Baptista, A., Tibério, L., & Fonseca, C. (2008, outubro 23-25). *Estratégias de valorização dos produtos tradicionais: o caso da região do Baixo Tâmega.* [Paper presentation]. *VII Colóquio Ibérico de Estudos Rurais - Cultura, Inovação e Território*, Coimbra. https://sper.pt/oldsite/actas7cier/PFD/Tema%20IV/4_1.pdf

Barroco, C., & Amaro, S. (2023). As rotas gastronómicas em Portugal: oportunidades e desafios futuros. *Revista Turismo & Desenvolvimento*, *40*, 57–66. https://doi.org/10.34624/rtd.v40i0.31423

Barroco, C., & Augusto, L. (2016). Turismo Gastronómico em Portugal: formas de comunicar os produtos endógenos da região Dão Lafões e Alto Paiva. *Anais Brasileiros de Estudos Turísticos*, *6*(2), 23–39. http://hdl.handle.net/10400.19/4141

Bellato, L., Frantzeskaki, N., & Nygaard, C. A. (2023). Regenerative tourism: a conceptual framework leveraging theory and practice. *Tourism Geographies*, *25*(4), 1026–1046. https://doi.org/10.1080/14616688.2022.2044376

Benaraba, C. M. D., Bulaon, N. J. B., Escosio, S. M. D., Narvaez, A. H. G., Suinan, A. N. A., & Roma, M. N. (2022). A Comparative Analysis on the Career Perceptions of Tourism Management Students Before and During the COVID-19 Pandemic. *Journal of Hospitality, Leisure, Sport and Tourism Education*, *30*, 100361. https://doi.org/https://doi.org/10.1016/j.jhlste.2021.100361

Benur, A. M., & Bramwell, B. (2015). Tourism product development and product diversification in destinations. *Tourism Management*, *50*, 213–224. https://doi.org/10.1016/j.tourman.2015.02.005

Cabo, P., Fernandes, A., & Ribeiro, M. I. (2020). VALORIZAÇÃO DE PRODUTOS ENDOGENOS EM TERRITÓRIOS RURAIS DE BAIXA DENSIDADE: Produção qualificada de caprinos na Região Interior Norte de Portugal. [Paper presentation]. *A Agricultura e Os Desafios Societais Para o Período 20-30 – Atas Do IX Congresso Da APDEA/ESADR 2019*, (pp. 329–343).

Capello, R., & Nijikamp, P. (2009). *Handbook of Regional Growth and Development Theories*. Edward Elgar Publishing.

Carneiro, M. J., & Eusébio, C. (2015). Host-tourist interaction and impact of tourism on residents' Quality of Life. *Tourism & Management Studies*, *11*(1), 25-34. https://doi.org/10.18089/

Carvalho, N. M. dos S. (2020). TURISMO E RECURSOS ENDÓGENOS COMO CATALIZADORES DO DESENVOLVIMENTO LOCAL DENSIDADE POPULACIONAL. In A. C. de Oliveira (Ed.), *Turismo, Socieadade e Ambiente* (pp. 23–29). Atena Editora. https://doi.org/https://doi.org/10.22533/at.ed.5532004123

Cordeiro, I., & Körössy, N. (2018). Quando as políticas públicas de turismo sustentável ignoram a dimensão social: reflexões a partir do estudo de caso de Fernando de Noronha (PE). *Caderno Virtual de Turismo*, *18*(3). https://doi.org/https://doi.org/10.18472/cvt.18n3.2018.1555

Comissão Interministerial de Coordenação do Portugal 2030. (2023). *Deliberação nº31/2023/PL, Classificação de Municípios e Freguesias de baixa densidade para efeitos de aplicação de medidas de diferenciação positiva dos territórios.* Consultado em 20 de março de 2025, de https://portugal2030.pt/wp-content/uploads/sites/3/2023/09/31_2023_PL_BaixaDensidade.pdf

Comissão Interministerial de Coordenação do Portugal 2020. (2015). *Deliberação nº55/2015, Classificação de Municípios de baixa densidade para aplicação de medidas de diferenciação positiva dos territórios.* Consultado em 20 de março de 2025, de https://poseur.portugal2020.pt/media/37804/db-cic-01-jul-5-territ%C3%B3rios-de-baixadensidade-1.pdf

Dias, F., Góis, S., & Gomes, G. (2024). O Turismo no Centro de Portugal: Satisfação dos Residentes, Impactos Percebidos e Envolvimento nas Decisões. *Revista Portuguesa de Estudos Regionais*, *69*, 95–111. https://doi.org/https://doi.org/10.59072/rper.vi69.599

Duque, A. S., Barroco, C., & Martins, M. D. L. (2023). Produtos certificados na génese de rotas turísticas: Uma oportunidade para conhecer a Região Centro. *Revista Turismo & Desenvolvimento*, *41*, 303–315. https://doi.org/10.34624/rtd.v41i0.30039

Duxbury, N., Bakas, F., Castro, T. V., & Silva, S. (2020). Turismo regenerativo. In Centro de Estudos Sociais da Universidade de Coimbra (Ed.), *Palavras para lá da pandemia: cem lados de uma crise* (p. 110). https://ces.uc.pt/publicacoes/palavras-pandemia/?lang=1&id=304039

Duxbury, N., Bakas, F. E., Vinagre de Castro, T., & Silva, S. (2021). Creative Tourism Development Models towards Sustainable and Regenerative Tourism. *Sustainability*, *13*(2), 1–17. https://doi.org/https://dx.doi.org/10.3390/su13010002

Easterling, D. S. (2004). The residents' perspective in tourism research: A review and synthesis. *Journal of Travel and Tourism Marketing*, *17*(4), 45–62. https://doi.org/10.1300/J073v17n04_05

Eusébio, C., Kastenholz, E., & Breda, Z. (2014). Turismo e desenvolvimento sustentável de destinos rurais: uma visão dos stakeholders. *Revista Portuguesa de Estudos Regionais*, (36), 13-21. https://doi.org/10.59072/rper.vi36.418

Gonda, T., Angler, K., & Csóka, L. (2021). The Role of Local Products in Tourism. *European Countryside*, *13*(1), 91–107. https://doi.org/10.2478/euco-2021-0006

Instituto Nacional de Estatística [INE]. (2003). *Densidade populacional (conceito n.º 166)*. Consultado em 14 de abril de 2025, de https://smi.ine.pt/Conceito/Detalhes/5008#Gloss%C3%A1rio

Jiang, Y., Lyu, C., & Balaji, M. S. (2025). Progress in research on tourists with mental disorders: A critical review and the way forward. *Tourism Management*, *107*, 105083. https://doi.org/10.1016/j.tourman.2024.105083

Jóia, A., & Carvalho, P. (2012). O Conceito de Produto Local, Tradicional de Qualidade e Tipicidade – PLTQT. *Gestão e Desenvolvimento*, *20*, 65–90. https://doi.org/10.7559/gestaoedesenvolvimento.2012.232

Kashimoto, E. M., Marinho, M., & Russef, I. (2002). Cultura, Identidade e Desenvolvimento Local: conceitos e perspectivas para regiões em desenvolvimento. *Interações (Campo Grande), 3*(4), 35–42. https://doi.org/10.20435/interacoes.v3i4.575

Khan, A., Bibi, S., Lorenzo, A., Lyu, J., & Babar, Z. U. (2020). Tourism and Development in Developing Economies: A Policy Implication Perspective. *Sustainability*, *12*(4), 1–19. https://doi.org/https://doi.org/10.3390/su12041618

Kim, J. H. (2014). The antecedents of memorable tourism experiences: The development of a scale to measure the destination attributes associated with memorable experiences. *Tourism Management*, *44*, 34–45. https://doi.org/10.1016/j.tourman.2014.02.007

Kovačić, S., Cimbaljević, M., Pavluković, V., & Jovanović, S. (2024). Exploring tourism competitiveness in developing economies: residents' perspective. *Discover Sustainability*, *5*(1). https://doi.org/10.1007/s43621-024-00416-x

Lee, W., Sung, H., Suh, E., & Zhao, J. (2017). The effects of festival attendees' experiential values and satisfaction on re-visit intention to the destination: The case of a food and wine festival. *International Journal of Contemporary Hospitality Management*, *29*(3), 1005–1027. https://doi.org/10.1108/ IJCHM-10-2015-0559

Li, P. Q., & Kovacs, J. F. (2022). Creative tourism and creative spectacles in China. *Journal of Hospitality and Tourism Management*, *49*, 34–43. https://doi.org/10.1016/j.jhtm.2021.08.023

Minnes, S., & Vodden, K. (2019). Introduction. In K. Vodden, D. Douglas, S. Markey, S. Minnes, B. Reimer (Eds.) *The Theory, Practice, and Potential of Regional Development* (pp.1–11). Routledge. https://doi.org/10.4324/9781351262163

Moleiro, D. F., Carneiro, M.J., & Breda, Z. (2021). Assessment of residents' perceptions and attitudes towards the appropriation of public spaces by tourists: the case of Aveiro. *International Journal of Tourism Cities.* 7(4), 922-942. https://doi.org/10.1108/IJTC-08-2020-0174

Moura, A. A., Mira, M. do R., & Teixeira, A. R. (2025). The Tourist Gastronomic Experience: Ties Between Young Foodies' Motivation and Destination Development in Portugal. *Tourism and Hospitality*, *6*(1), 1–22. https://doi.org/https://doi.org/10.3390/tourhosp6010007

Nascimento, M. S. M., Abrantes, A. A. da C., & Costa, N. F. da. (2014). O turismo no desenvolvimento regional e o seu financiamento. *Tourism and Hospitality International Journal*, *3*(1), 30–45. https://revistas.rcaap.pt/thij/article/view/30137/21596

Observatório do Turismo Sustentável do Centro de Portugal (2025). *Observatório.* Consultado em 10 de outubro de 2025, de https://smat.observatorio-tcp.pt/otscp/#observatorio

Oliveira, N. M. (2021). REVISITANDO ALGUMAS TEORIAS DO DESENVOLVIMENTO REGIONAL Revising classical regional development theories. *Informe GEPEC*, *25*(1), 203–219. https://doi.org/10.48075/igepec.v25i1.25561

Pato, M. L., & Scherer, A. (2023). Valorização Dos Produtos Endógenos: O Caso Da Fels Natural, Portugal. In A. C. de Oliveira (Ed.), *Ciências agrárias: conhecimentos teóricos, metodológicos e empíricos* (pp. 25–36). Atena Editora. https://doi.org/10.22533/at.ed.2352330104

Piffer, M., Alves, L. R., Ferreira de Lima, J., Cavalheiro, M. E., & Silva, M. G. (2006). Desenvolvimento regional do Oeste Paranaense a partir do capital social. [Paper Presentation]. *IV Seminário Internacional Sobre Desenvolvimento Regional -SIDR, Santa Cruz do Sul*. https://www.researchgate.net/publication/347524176_DESENVOLVIMENTO_REGIONAL_DO_OESTE_PARANAENSE_A_PARTIR_DO_CAPITAL_SOCIAL

Pike, A., Rodrígues-Pose, A., & Tomaney, J. (2006). Introduction. In A. Pike, A.Rodríguez-Pose, J. Tomaney (Eds.), *Handbook of Local and Regional Development*. (pp.1–23). Routledge. https://doi.org/10.4324/9780203842393.ch4

Qureshi, S. (2019). Perspectives on development: why does studying information and communication technology for development (ICT4D) matter? *Information Technology for Development*, *25*(3), 381–389. https://doi.org/10.1080/02681102.2019.1658478

Ramos, D. (2019). Recursos Endógenos no Turismo. In P. Almeida (Coord.), *Manual de Boas Práticas e Sustentabilidade no Turismo* (pp. 27–30). AIRO. http://hdl.handle.net/10400.8/5910

Reis, P., & Baltazar, M. da S. (2019). Os territórios rurais de baixa densidade como espaço de lazer e de turismo. O destino turístico Aldeias Históricas de Portugal. *Sociologia on Line*, *21*, 141–166. https://doi.org/10.30553/sociologiaonline.2019.21.6

Reis, P., Ramos, G., & Rodrigues, J. (2024). Tourism planning in low-density territories: the case of the municipality of Vila de Rei. *XV International Tourism Congress*, *(pp.*200–209). Sciendo. https://doi.org/10.2478/9788367405287-022

Ribeiro, J. A. C., Vareiro, L. C., Fabeiro, C. P., & de Blas, X. P. (2005, agosto). The tourism potential of board regions - endogenous resources and destination image evaluation. {Conference Paper], *45th Congress of the European Regional Science Association: "Land Use and Water Management in a Sustainable Network Society.", Amesterdão.* https://hdl.handle.net/10419/117436

Ritchie, J., & Crouch, G. (2003). *The Competitive Destination A Sustainable Tourism Perspective*. CABI Publishing.

Rivera, M., Croes, R., & Lee, S. H. (2016). Tourism development and happiness: A residents' perspective. *Journal of Destination Marketing and Management*, *5*(1), 5–15. https://doi.org/10.1016/j.jdmm.2015.04.002

Rodrigues, W. S. (2021). A importância da promoção de produtos endógenos para o desenvolvimento local sustentável da CIM Região de Coimbra. In Universidade de Aveiro (Ed.), *XI Encontro de Investigadores da Qualidade* (pp. 554–572). https://publicacoes.riqual.org/wp-content/uploads/2022/02/troia_xi_554_574.pdf

Sapkota, K. P., Palamanit, A., Techato, K., Gyawali, S., Ghimire, H. P., & Khatiwada, B. (2024). The Role of Local Community in Enhancing Sustainable Community Based Tourism. *Journal of Electrical Systems*, *20*(7), 558–571. https://doi.org/https://doi.org/10.52783/jes.3360

Silva, F. A., & Lopes, T. A. F. M. (2020). Application of Smart Tourism to Nature-Based Destinations. In L. Carvalho, L. Calisto, & N. Gustavo (Eds.), *Strategic Business Models to Support Demand, Supply, and Destination Management in the Tourism and Hospitality Industry* (pp. 1–20). IGI Global Scientific Publishing. https://doi.org/https://doi.org/10.4018/978-1-5225-9936-4.ch001

Silva, L. (2013). Impactos do turismo em meio rural. Reflexões a partir de Portugal. In V. Silva & R. Carmo (Eds.), *Mundo Rural: Mito ou Realidade?*(pp.295–313). Annablume.https://www.researchgate.net/publication/258217639_Impactos_do_turismo_em_meio_rural_Reflexoes_a_partir_de_Portugal

Soares, I., & Dias, F. (2024). O Potencial de Regeneração do Património Olivícola em Portugal com Suporte no Turismo Criativo. *Revista Portuguesa de Estudos Regionais*, *68*, 29–46.

https://doi.org/https://doi.org/10.59072/rper.vi68.603

Stevic, I., Rodrigues, V., Breda, Z., Veríssimo, M., Silva, A. M. F. & Costa, C. M. M. (2024). Residents' perception of negative tourism impacts and mitigation strategies: the case of Porto. *International Journal of Tourism Cities, 10 (4),* 1488-1506. https://doi.org/10.1108/IJTC-11-2022-0254

Turismo Centro de Portugal. (2025). *Annual Progress Report 2023.* Plataforma interna do Observatório do Turismo Sustentável do Centro de Portugal.

Turismo de Portugal. (2017). *Estratégia de Turismo 2027*. Consultado em 8 de março de 2025, de https://www.turismodeportugal.pt/SiteCollectionDocuments/estrategia/estrategia-turismo-2027.pdf

Vareiro, L. C., & Ribeiro, J. C. (2007). Sustainable use of endogenous touristic resources of rural areas: two portuguese case studies. *PASOS Revista de Turismo y Patrimonio Cultural*, *5*(2), 193–208. https://doi.org/10.25145/j.pasos.2007.05.015

Willis, K. (2011). *Theories and Practices of Development: Second Edition*. Routledge. https://doi.org/10.4324/9780203844182

Zhang, D., Wang, Q., & Yang, Y. (2023). Cure-all or curse? A meta-regression on the effect of tourism development on poverty alleviation. *Tourism Management,* 94, 104650. https://doi.org/10.1016/j.tourman.2022.104650

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Mozambican Tomato Markets: Structural Breaks and Their Impact on Price Transmission and Integration

Mercado de Tomate em Moçambique: Quebras Estruturais e Seus Impactos Sobre a Transmissão e Integração de Preços

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Abstract

This study analyzed the influence of structural breaks on the integration and transmission of tomato prices in the Maputo, Moamba, and Chókwè markets in southern Mozambique (2015-2019), using ANOVA, Tukey-HSD, ADF, DF-GLS, Franses-Haldrup for outliers, and Gregory-Hansen tests for cointegration with structural breaks. The results showed significant differences in average prices, as well as a strong interaction between the Chókwè, Moamba, and Maputo markets. The cointegration of the tomato price series across the analyzed markets and the identification of a break in February 2019 indicate a structural change in tomato prices in Chókwè and Moamba, highlighting their significant influence on price stability in Maputo. The ARDL-ECM (1,0,2,0,0,0) and ARDL-ECM (1,0,2) models suggest that long-term fluctuations in tomato prices in Maputo result from exogenous shocks from Chókwè and Moamba. Therefore, it is necessary to improve early-warning systems for extreme weather events and information sharing, as well as reduce barriers that inhibit efficient price transmission between markets.

Keywords: Adverse Shocks, Structural Break, ARDL-ECM Analysis, Maputo, Moamba and Chókwè Markets.

JEL Codes: Q11, R32, D40

Resumo

Este estudo analisou a influência de quebras estruturais na integração e transmissão dos preços do tomate nos mercados de Maputo, Moamba e Chókwè no sul de Moçambique (2015-2019), usando ANOVA, Tukey-HSD, ADF, DF-GLS, Franses-Haldrup para outliers e testes de Gregory-Hansen para cointegração com quebras estruturais. Os resultados mostraram diferenças significativas nos preços médios, bem como uma forte interação entre os mercados de Chókwè, Moamba e Maputo. A cointegração da série de preços do tomate nos mercados analisados e a identificação de uma quebra em fevereiro de 2019 indicam uma mudança estrutural nos preços do tomate em Chókwè e

Moamba, destacando sua influência significativa na estabilidade de preços em Maputo. Os modelos ARDL-ECM (1,0,2,0,0,0) e ARDL-ECM (1,0,2) sugerem que as flutuações de longo prazo nos preços do tomate em Maputo resultam de choques exógenos de Chókwè e Moamba. Portanto, é necessário melhorar os sistemas de alerta precoce para eventos climáticos extremos e o compartilhamento de informações, bem como reduzir as barreiras que inibem a transmissão eficiente de preços entre os mercados.

Keywords: Choques adversos, ruptura estrutural, análise ARDL-ECM, mercados de Maputo, Moamba e Chókwè.

JEL Codes: Q11, R32, D40

1. INTRODUCTION

Mozambique's geographical location and topography render the country particularly vulnerable to global climate change, increasing its exposure to more frequent and intense tropical cyclones, floods, and droughts (USAID, 2018). These weather events impact agricultural production, disrupt local markets, and jeopardize household livelihoods and food security of rural communities (FAO *et al.*, 2023). Climate shocks also affect logistics, infrastructure and agricultural markets, foster market fragmentation and widen price disparities (Dercon, 1995). Consequently, producers with limited access to price information and risk management mechanisms (Van Campenhout, 2012) become more susceptible to manipulation by intermediaries, who often impose non-competitive prices (Zidora *et al.*, 2022).

This scenario establishes barriers to the effective integration of agricultural markets, undermining the efficient transmission of prices between production and consumer regions. Within this framework, the present study aims to examine how exogenous shocks influence market integration and price transmission in local markets. In this way, the guiding question of this study is: How do structural breaks caused by exogenous shocks, such as extreme climate events, influence the integration and asymmetric price transmission dynamics among the tomato markets of Maputo, Moamba, and Chókwè in southern Mozambique? In other words, we intend to examine the integration of tomato markets in southern Mozambique and the transmission of price signals among these areas.

Notwithstanding advances in the literature on agricultural price integration and transmission (Baulch, 1997) and its empirical application in Africa (Yacob, Zeray, 2025; Bekoe, 2023; Onubogu, Dipeolu, 2021), a gap remains in the analysis of African horticultural markets vulnerable to recurrent climate shocks — Mozambique being a representative case. In this context, Venkat and Master (2023) already highlighted the need for price analysis of food groups, such as fruits, vegetables, and animal-based foods. Furthermore, most studies have centered on cereals or export commodities and have overlooked the structural disruptions triggered by extreme climatic events. This research contributes to the understanding of spatial price integration in Mozambique's tomato markets by incorporating the effects of structural breaks and exogenous shocks.

In integrated markets, food commodities typically flow from surplus to deficit regions (Abay *et al.*, 2023). In this setting, the southern region of Mozambique serves an essential role in sustaining the diet, income and livelihoods of local communities through the vegetable cultivation (Zidora *et al*, 2022). The region accounts for more than 90% of the area cultivated with food crops has tomatoes, cabbage and onions as the main crops produced by small and medium-sized producers (Quilambo; Zavale; Cribb; Cachomba, 2015). However, Mozambique's high exposure to adverse climate events has increase dependence on food imports, driving up food prices and revealing the structural weaknesses of its agricultural sector (Marassiro; Oliveira; Perreira, 2021).

Regarding the spatial scope of analysis, the selection of study regions is justified by their relevance in the national marketing network. According to the Famine Early Warning Systems Network (FEWSNET), Maputo is considered the main consumer market for agricultural products in the region. The Moamba district, through the Zimpeto and Fajardo markets, is considered the largest commercial hub for agricultural products supplying the province and the city of Maputo. In turn, Chókwè is recognized as the reference market for the southern region (FEWSNET, 2021). Price fluctuations caused by adverse shocks in these regions are conveyed to other markets, impacting the purchasing power of Mozambican households, particularly those with limited income.

In turn, the temporal scope of the analysis is defined by the occurrence of extreme events – cyclones, floods, and droughts. The most significant cyclones included Dineo (2017), Desmond (January 2019), Idai (March 2019), Kenneth (2019), Belna (December 2019), Chalane (December 2020), Eloise (January 2021), Guambe (March 2021), Gombe (March 2022), and Freddy (January and February 2023). In turn, the major floods occurred in 2000, 2013, and 2023, and the main drought occurred in the South and Center of Mozambique.

Accordingly, an analysis of the average annual growth rates of harvested area, production, and yield of tomatoes in Mozambique, from 2014 to 2020, reveals an annual growth of 20.8% in area, 25% in production, and 2.9% in average yield (FAOSTAT, 2025). The vegetable market in Mozambique is relatively informal and underdeveloped. Notwithstanding its deficiencies and lack of formality, national vegetable production sustains 20 million Mozambicans, with tomatoes comprising 77% of the designated area and the vegetable market (Ecole and Malia, 2015; Zavale, Cribb, Quilambo, and Cachamba, 2015).

The domestic vegetable supply market in Mozambique is characterized by "informal" activities predominantly located in extensive irrigated regions in the south, including Moamba and Chókwè, as well as the Green Zones adjacent to major consumer hubs such as Maputo, Beira, Chimoio, and Nampula, mainly in urban and peri-urban areas, particularly in the southern region. The domestic market is supplied with both local and imported vegetables, predominantly from South Africa.

The main vegetables include tomatoes, onions, cabbage, green beans, peppers, beets, garlic, lettuce, kale, and carrots. Gradually, the assortment of products is broadening to encompass processed or value-added items, including pre-washed vegetables. Finally, the majority of transactions involving agricultural products are centered on relationships. Transactions persist in direct exchanges inside physical markets, and economies of scale in marketing are not entirely exploited.

Finally, this article is organized into six sections, including this introduction. Section 2 presents the theoretical fundamentals on price transmission, market integration and structural breaks. Section 3 discusses empirical studies on price transmission and market integration in Mozambique; Section 4 details the methodological procedures, including descriptive, correlation, ANOVA, and cointegration analyses; Section 5 synthesizes and discusses the main findings; and Section 6 offers the conclusions and policy recommendations.

2. THEORETICAL FUNDAMENTS

This section outlines the main theoretical foundation of the transmission and integration of agricultural markets and their association with structural breaks in time series analysis. Regarding the integration of agricultural markets, it is usually categorized as either spatial (horizontal) or vertical. In the case of horizontal integration, which is the scope of this article, two product markets within a single currency area are said to be integrated if, when trade takes place between them, price in the importing market equals price in the exporting market plus the transfer costs of moving the product between the two markets. Transfer costs encompass transportation, storage and processing expenses plus a nominal margin for the merchant's standard profit (Baulch, 1997).

In this way, integrated food markets are characterized by the simultaneous determination of prices. This simultaneity allows for the analysis of market interconnection and the efficiency of price transmission. The price transmission refers the process through which price changes in one market, region, or chain segment are transmitted to another (Balcombe; Marrisson, 2002) which may be symmetric or asymmetric (Minot, 2001). In this context, asymmetries in price transmission are detected when the intensity or speed of adjustment differs between positive and negative shocks within a price series (Presotto; Freitas & Oliveira, 2023).

In integrated markets, even in the absence of trade flows, the flow of information allows the transmission of price signals between these markets (Facker & Tastan, 2008). On the other hand, the lack of integration means that price signals do not flow adequately from regions with supply shortages to those with surpluses (Akhter, 2007). The absence of integration may lead to price distortions and inefficient resource allocation, compromising the efficiency and equity of food distribution (Sicsú; Castelar, 2009).

Price series correlation is regarded as a convenient indicator of market integration, but this approach has been strongly criticised despite its simplicity in the literature on market performance in rural areas (Ravallion, 1986). Nonetheless, the literature on time series has supported the advancement of econometric methods for assessing markets integration. This progression underlines the concepts of causality (Granger, 1969) and cointegration (Engle and Granger, 1987; Johansen, 1988), and the popularization of models like the ARDL (Ravallion, 1986; Blank and Schmiesing, 1988; Alexander and Wyeth, 1994). Despite analytical advances, many models still employ the assumption of linear model stability over time, an assumption that has been frequently criticized.

Consequently, structural break testing frameworks emerged as a methodological response to the challenge of capturing changes in time series dynamics. The analysis of structural breaks encompassed tests to identify their existence, estimate the date of the break, and conduct tests incorporating unit roots and structural breaks (Andrews, 1993). Early methodologies from the 1960s relied on exogenous assumptions about break dates, while later approaches — especially from the 1990s — introduced endogenous estimation of multiple breaks in the presence of unit roots (Bai & Perron, 1998; Zivot & Andres, 2002; Perron, 2006).

Other approaches have prominently emerged in literature applied to test market integration in underdeveloped countries, as noted by Mafimisebi (2012) and Van Campenhout (2007, 2012), which include: correlation analysis, the Law of One Price (LOP), Granger causality tests, the Ravallion model, and cointegration. However, recent studies — particularly those focusing on Mozambique's economy and the Southern African Development Community (SADC) region — demonstrate the use of advanced multivariate econometric techniques, such as: vector autoregression (VAR), Granger causality tests, Cointegration Test, Threshold Autoregressive (TAR) Model, Multivariate Asymmetric Price Transmission Framework Model, and Multivariate Vector Error Correction Model (VECM) integration and asymmetry in price transmission (Mandizvidza, 2013; Amikuzuno, 2009; Ihle & Amikuzuno, 2010).

Building upon this theoretical and empirical background, the present study applies the Nonlinear Autoregressive Distributed Lag (NARDL) model to investigate asymmetric price transmission and market integration in Mozambique's tomate markets. The NARDL methodology, formulated by Shin et al. (2014), enhances the linear ARDL framework by allowing potential asymmetries in both short- and long-term interactions, rendering it especially applicable in scenarios where structural breaks and nonlinear adjustments are anticipated.

3. METHODOLOGY

The study initially evaluates the behavioral patterns of tomato prices in the southern Mozambican markets. In the exploratory analysis, Spearman's rank correlation is used to assess price movements between markets, while ANOVA evaluates whether average prices differ significantly between Maputo, Moamba and Chókwè. Furthermore, Tukey's Honestly Significant Difference (HSD) test is used to identify which market pairs exhibit statistically significant differences in mean prices. For this purpose, joint ranges are calculated with a $1-\alpha\%$ confidence level for all possible pairwise comparisons between means, expressed as $\mu_I - \mu_{I'} \in (\widetilde{y_I} - y_{I'}) \pm HSD$. The null hypothesis ($H_0$) is accepted if $|\widetilde{y_I} - y_{I'}| \leq HSD$; otherwise, it is rejected, indicating a significant difference between the two-market means.

Thereafter the evaluation of price variability, the process investigates the existence of unit roots to confirm the stochastic properties of the series. The study conducts ADF and DF-GLS unit root, in conjunction, to enhance robustness and reliability of results. As a complementary procedure, the methodology of Franses and Haldrup (1994) was utilized to detect outliers and mitigate the erroneous effects induced by anomalous observations in the identification of unit roots.

The optimal lag length is selected based on the minimum AIC, AICc, and BIC criteria (Fabozzi et al., 2014). Subsequently, The Gregory-Hansen cointegration test (1996) with structural break was also applied, an extension of the traditional cointegration test designed to account for potential structural changes in long-term relationships between I (0) and I (1) or I (1) series.

The Gregory and Hansen approach estimates a cointegrating regression with a possible regime change and, for each candidate breakpoint (τ), calculates ADF-type statistics. This test presents three test statistics resulting from the residuals of the cointegrating regression featuring a breakpoint:

$$Z_a(\tau) = n(\hat{\rho}_\tau^* - 1); \quad Z_\tau(\tau) = \frac{(\hat{\rho}_\tau^* - 1)}{\xi_\tau}, e \quad \hat{s}_\tau^2 = \frac{\hat{\sigma}_\tau^2}{\sum_1^{n-1} \hat{e}_{t\tau}^2} \qquad [1]$$

Where, $\hat{\rho}_\tau^*$ is the estimated autoregressive coefficient with ξ_τ as its default error, $\hat{\sigma}_\tau^2$ is the variance of the regression error of the residuals.

The test determines the minimal value of each statistic as the pertinent test statistic. If these values are lower the critical thresholds, the null hypothesis of no cointegration is rejected, signifying the presence of a cointegrating relationship with a structural break. Based on the results of the cointegration analysis, the long-run relationship is estimated using the ARDL bounds testing approach, while short-run adjustments are captured through the corresponding Error Correction Model (ECM).

$$\Delta lnP_{map_t} = \alpha_1 + \alpha_2 D_{TB} + \sum_{i=1}^{p} a_{1i} \Delta lnP_{map_{t-1}} + \sum_{i=1}^{q} a_{2i} \Delta lnP_{ch_{t-1}} + \sum_{i=1}^{q} a_{3i} \Delta lnP_{moa_{t-1}} + \gamma t + \delta t D_{TB} + \lambda ECT_{t-1} + u_t, \qquad [2]$$

Where, Δ represents the variables in first difference, α_1 is the intercept before the break and α_2 the change in the intercept due to the break. a_{ni} are coefficients of the independent variable; y_t (P_{map_t}) is dependent variable, x_t are independent variables ($P_{ch_{t-1}}$, $P_{moa_{t-1}}$) in the time dimension t; t is trend, γ is coefficient of the trend before the structural break, and δ is change in the coefficient of the trend due to the structural break. *TB*=point of rupture or structural break, D_{TB}=dummy variable that takes on a value of 0 before the structural break and 1 after the structural break, i.e. $D_{TB} = 0$ if TB≤t and $D_{TB} = 1$ if TB>t; u_t is the error term. p_{map} is price of tomatoes in Maputo expressed in mzn/kg, p_{tch} is price of tomatoes in Chókwè expressed in mzn/kg, p_{moa} is price of tomatoes in Moamba expressed in mzn/kg. ln=logarithm

The diagnosis of the model was based on the White Test for heteroscedasticity, the Breusch-Godfrey LM test for autocorrelation, the Jarque-Bera test for normality of the residuals, and the Cusum test and Cusumsquare Test for analyzing the stability of the model parameters.

This investigation extends the linear ARDL to a nonlinear form (Shin, Yu, and Greenwood-Nimmo, 2014) – also called ARDL Asymmetric Effects (NARDL), to investigate potential nonlinearities in price transmission. With certain adaptations, framed in an ARDL configuration along the lines of Pesaran and Shin (1998) and Pesaran et al. (2001), it can be rewritten as:

$$\Delta y_t = \rho \Delta y_{t-1} + \begin{pmatrix} \theta^+ x_{t-1}^+ \\ + \\ \theta^- x_{t-1}^- \end{pmatrix} + \sum_{j=1}^{p-1} \varphi_i \Delta y_{t-i} + \sum_{j=0}^{q-1} \begin{pmatrix} \pi_j^+ \Delta x_{t-j}^+ \\ + \\ \pi_j^- x_{t-j}^- \end{pmatrix} + \varepsilon_t \rho \zeta_{t-1} + \varepsilon_t \qquad [3]$$

With: $\rho = \sum_{j=1}^{p} \theta_{j-1}$; $\varphi_i = -\sum_{i=j+1}^{p} \theta_i$; $\theta^+ = \sum_{j=0}^{q} \theta_j^+$; $\theta^- = \sum_{j=0}^{q} \theta_j^-$, $\pi_0^+ = \theta_0^+$, $\pi_0^- = \theta_0^-$,
$\pi_j^+ = -\sum_{j=j+1}^{q} \theta_j^+$ e $\pi_j^- = -\sum_{j=j+1}^{q} \theta_j^-$.

In addition, $\zeta_{t-1} = \Delta y_t - \beta^+ x_t^+ - \beta^- x_t^-$ is the non-linear ECM, with $\beta^+ = -\theta^+/\rho$ and h $\beta^- = -\theta^-/\rho$ being long-term asymmetric parameters that represent the impacts of increasing and decreasing x_t on y_t. $\sum \pi_j^+$ measures the short-term influences of increasing x_t on y_t, while $\sum \pi_j^-$ measures the short-term influences of decreasing x_t on y_t. The hypothesis to be tested in the model is $H_0: \theta_0 = \theta_1^+ = \theta_1^- = \theta_2^+ = \theta_2^- = 0$.

Based on the study variables, the NARDL model for each price series can be rewritten as follows:

$$\Delta Y_t = \rho Y_{t-1} + \begin{matrix} \theta^+ X_{t-1}^+ \\ + \\ \theta^- X_{t-1}^- \end{matrix} + \begin{matrix} \theta^+ W_{t-1}^+ \\ + \\ \theta^- X_{t-1}^- \end{matrix} + \sum_{j=0}^{q-1} \begin{pmatrix} \pi_j^+ \Delta X_{t-j}^+ \\ + \\ \pi_j^- \Delta X_{t-j}^- \end{pmatrix} + \sum_{j=0}^{q-1} \begin{pmatrix} \pi_j^+ \Delta W_{t-j}^+ \\ + \\ \pi_j^- \Delta W_{t-j}^- \end{pmatrix} + \sum \varphi_i \Delta Y_{t-i} + \varepsilon_t \qquad [4]$$

The average prices of tomatoes, denoted as $Y_t = lnP_{map_t}$ in Maputo, $X_t = lnP_{chok_t}$ in Chókwè, and $W_t = lnP_{moa_t}$ in Moamba, are stated in mts/kg across several markets. The long-term coefficients of each lagged variable are determined by dividing the negative of the corresponding coefficient, θ^+ and θ^-, by the coefficient ρ. The $\sum \pi_j^+$ and $\sum \pi_j^-$ quantifies the short-term effects of tomato price.

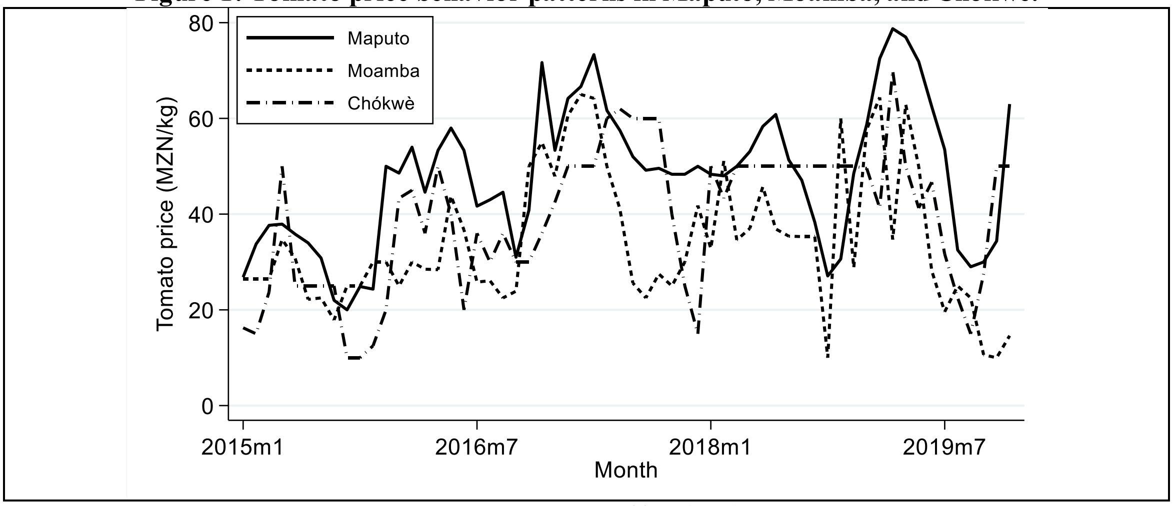
The diagnosis will be conducted utilizing the subsequent tests: i) The Portmanteau Test facilitates a comprehensive assessment of the potential inclusion of various non-linear transformations of combinations of explanatory variables alongside a chosen model structure. ii) Breusch/Pagan Heteroskedasticity Test, which evaluates heteroscedasticity in a regression model; iii) Ramsey RESET Test, which identifies specification errors in the regression equation; and iv) Jarque-Bera Test on Normality, which assesses normality based on the skewness and kurtosis of the data.

4. RESULTS AND DISCUSSION

4.1 Descriptive and variability analysis

The graphical analysis of tomato prices revealed high-frequency fluctuations originating from multiple factors. As noted by Adhikari & Agrawal (2013), these fluctuations behave erratically, without any clear pattern. While USAID (2018) and Ndapassoa (2023) have indicated that Mozambique has been experiencing an increase in the frequency of cyclones, floods and droughts, which have disrupted local markets and negatively impacted farmers' incomes (USAID, 2018; Matias, 2016; Mazive, 2017).

Figure 1: Tomato price behavior patterns in Maputo, Moamba, and Chókwè.



Source: SIMA Mozambique (2024)

In turn, the correlation matrix showed an average positive correlation between the market pairs of Chókwè and Maputo, as well as Moamba and Maputo, with correlation values of 0.66 and 0.58, respectively. The correlation between the prices of tomatoes in Moamba and Chókwè was also positive, but weak (Table 1).

Table 1: Correlation matrix of tomato prices in the Maputo, Chókwè, and Moamba markets

Matrix (obs=60)	lnP_{map}	lnP_{ch}	lnP_{moa}
lnP_{map}	1.000		
lnP_{ch}	0.655^{***}	1.000	
lnP_{moa} +	0.576^{***}	0.239^{*}	1.000

Source: prepared by the author

Note: Tomate price in Maputo (lnP_{map_t}), Chókwè (lnP_{ch_t}) and Moamba (lnP_{moa_t}) expressed in MZN/kg. ln=logarithm. Significance level: (***) =1%, (**) =5%, (*) =10%.

The positive average correlation between the Maputo and Moamba tomato markets is substantiated by Zavale *et al.* (2015) due to the Zimpeto wholesale market in Maputo being the predominant marketing hub for tomatoes cultivated in the Moamba district. In this context, over 70% of tomato producers in the Moamba district sell their produce primarily in Maputo city, with 3.3% directed to the Fajardo market and the remaining 64.1% designated for the Zimpeto wholesale market, which serves as the predominant outlet for tomatoes from Moamba producers.

The commercial relationship between the markets of Chókwè and Moamba is small, and all of them have a strong dependence on the large consumption center of Maputo city. In addition, they help local markets with supplies more efficiently than more distant markets, which tend to face greater challenges linked to logistical barriers, packaging, according to Chambo (2013), access to transportation and regulations (toll costs, weight and speed limitations), resulting in less intense and frequent interactions, as is the case between the Moamba and Chókwè markets.

As part of the exploratory analysis phase, the analysis of variance showed some differences in the average prices of tomatoes in the markets of Maputo, Chókwè, and Moamba, as pointed out in Table 5. Given the non-normal distribution of prices in the Chókwè markets, as evidenced by Skewness/Kurtosis, the conditions for applying a parametric ANOVA test were not met. Therefore, the Kruskal-Wallis test was used as a non-parametric alternative to ANOVA for independent sample.

Table 2: ANOVA, Levene, Skewness/Kurtosis test and Krustal-Wallis test of Tomato Prices in the Maputo, Moamba, and Chókwè Markets.

Panel a) ANOVA

Prices	Sum of Squares	df	Average Square	F	Sig.
Between groups	5.518,005	2	2.759,003	12,953	0,000
In the groups	37.700,253	177	212,996		
Total	43.218,259	179			

Panel b) Levene's Test of Homogeneity of Variance

Levene Statistic	df1	df2	Sig.
0,476	2	177	0,622

Panel c) Skewness/Kurtosis tests for Normality

Markets	Pr (Skewness)	Pr (Kurtosis)	adj chi2(2)	Prob>chi2
P_{map}	0.0864	0.5847	3.40	0.1828
P_{ch}	0.0017	0.4454	8.96	0.0113
P_{moa}	0.1220	0.2820	3.73	0.1552

Panel d) Statistics of the Krustal-Wallis test

Tests	Statistics
Qui-square	21,163
Df	2
Asymptotic Significance	0,000
b. Grouping Variables: Market	

Source: prepared by the author.

Note: Tomate price in Maputo (P_{map_t}), Chókwè (P_{ch_t}) and Moamba (P_{moa_t}) expressed in MZN/kg.

According to Martinez and Ferreira (2010), the Krustal Wallis test allows detection of meaningful differences between central values of three or more situations, when it is considered different subjects. As for the Krustal-Wallis test shown in Table 6, it validates the ANOVA results, making it evident that, on average, the prices of tomatoes on the analyzed markets presented some meaningful differences.

In this regard, Tukey's multiple comparisons revealed that the tomato prices in Maputo were on average 8.48 MZN/kg higher than the price in the Chókwè market, and 13.41 MZN/kg higher than the price in Moamba, standing out from the other markets. Junior, Bazo, and Romão (2022) indicate that this phenomenon is frequently observable from January to March, when tomato prices in the markets of Maputo City peak. During April and June, tomato prices exceed the average in the marketplaces of Maputo province, Maputo city, and Gaza. From July to November, prices in Gaza province exceed the average until September, subsequently declining from October through the remainder of the year, whilst other provinces experience a resurgence in prices in December.

Table 3: Tukey's Multiple Comparison Results for Tomato Prices Across Markets

Painel a) Tukey's Simultaneous Multiple Comparison Tests for Mean Differences

	(I) Markets	(J) Markets	Mean Difference (I-J)	Standard model	Sig.	Confidence interval 95%	
						Inferior limit	Superior limit
Tukey HSD	P_{map}	P_{ch}	8,481*	2,664	0,005	2,183	14,778
		P_{moa}	13,406*	2,664	0,000	7,108	19,704
	P_{ch}	P_{map}	-8,481*	2,664	0,005	-14,778	-2,183
		P_{moa}	4,926	2,664	0,157	-1,372	11,223
	P_{moa}	P_{map}	-13,406*	2,664	0,000	-19,704	-7,108
		P_{ch}	-4,926	2,664	0,157	-11,223	1,372

Painel b) Information from Homogeneous Subsets using Tukey's Method and 95% Confidence

	Markets	Alpha subsets = 0.05	
		1	2
Tukey HSD[a]	P_{map}	34,2933	
	P_{ch}	39,2188	
	P_{moa}		47,6993
	Sig.	0,157	1,0

Source: prepared by the author.

Note: Tomate price in Maputo ($\boldsymbol{lnP_{map_t}}$), Chókwè ($ln\,P_{ch_t}$) and Moamba (lnP_{moa_t}) expressed in MZN/kg.

The tomato prices in Chókwè and Moamba have homogeneous subsets, in contrast to prices in Maputo, which have inhomogeneous subsets. This differential makes Maputo City's markets the preferred markets for tomatoes, as it is a major consumption center in the southern region (Campenhout, 2012). This result highlights a scenario that reflects a certain instability in the supply of tomatoes, resulting from large deficits or low supplies of tomatoes in the Maputo city markets, which affect the price dynamics in these markets. However, whether the markets are integrated and whether the price signals derived from shocks are transmitted between the markets analyzed, and the magnitudes of these signals, is a subject to be addressed in later topics.

4.2 Stationarity tests and structural break analysis

Based on the ADF and DF-GLS tests, the series proved to be integrated in different orders. In other words, they were stationary in level and in first difference, with a combination of the I(0) and I(1) series. In this case, VAR or VECM models should not be applied directly. Therefore, ARDL (AutoRegressive Distributed Lag) models are used, as they allow for variables with mixed integration orders.

And the Engle-Granger or Johansen cointegration tests are not applicable, as they require all variables to be I(1). In this situation, the Bound Test associated with the ARDL model (AutoRegressive Distributed Lag Model), proposed by Pesaran et al. (2001), is used. After detecting cointegration, the ARDL model with an error correction term (ECM) is estimated to analyze the short- and long-term dynamics of the series.

Table 4: Augmented Dickey-Fuller Test and DF-GLS for Unit Roots

Series	Variables	Test statistics	Order Integration	Test statistics	Order Integration
In level	lnP_{map}	-3.478**	I(0)	-3.957	I(0)
	lnP_{ch}	-3.124**	I(0)	-3.315**	I(0)
	lnP_{moa}	-2.039	-	-2.113	-
1st dif.	$d.lnP_{map}$	-3.934	I(0)	-3.438**	I(0)
	$d.lnP_{ch}$	-5.506	I(0)	-5.559	I(0)
	$d.lnP_{moa}$	-4.455**	I(1)	-4.336**	I(1)

Source: prepared by the author

Note: Tomate price in Maputo (lnP_{map_t}), Chókwè (lnP_{ch_t}) and Moamba (lnP_{moa_t}) expressed in MZN/kg. ln=logarithm. Significance level: (***) =1%, (**) =5%, (*) =10%. (-) =presence of unit root

Regarding Zivot-Andrews and Bai-Perron tests for structural breakage$Z_\tau(\tau)$, statistics from the Zivot-Andrews test indicate that structural breakage is present in the model. These results reinforce the supW(tau) statistics of the Bai and Perron test, which provide analytical and numerical evidence that there are multiple break points in the structure of the series analyzed, which show the presence of multiple exogenous shocks that affected the dynamics of the series on the dates highlighted in notes (a), (b) and (c) of Table 10, suggesting the possibility of structural changes in the short and long-term relationships between the variables analyzed.

Table 5: Zivot & Andrews and Bai & Perron structural break test for tomato prices in the Maputo, Moamba and Chókwè markets

Test	Coef.	ΔlnPtmap	ΔlnPtmoa	ΔlnPtch
Zivot Andrews test	Z_stats	-5.035 **	-3.319	-4.343 **
	Break	2015m12	2016m11	2016m1
Bai & Perron test	supW(tau)	2.99**(a)	1.91 (b)	3.68***(c)

Source: prepared by the authors based on the results of the tests described above.

Note: Significance level: (***)=1%, (**)=5%, (*)=10%, number of lags (2) included based on the AIC in the unit root tests, : ptmap=tomato price in Maputo expressed in mzn/kg, ptch=tomato price in Chókwè expressed in mzn/kg, ptmoa=tomato price in Moamba expressed in mzn/kg.D=first difference, ln=natural logarithm. Estimated structural break points under hypothesis H0: no break(s) vs. H1: 5 break(s): (a) 2015m11 2016m11 2017m8 2018m5 2019m2; (b) 2015m11 2016m11 2017m8 2018m5 2019m3; (c) 2015m12 2016m12 2017m9 2018m6 2019m3; at 2016m1

If there is a structural break in the time series, the traditional unit root and cointegration tests such as ADF, Engle-Granger, Johansen and Bound Test can generate invalid or misleading results. This is because these tests assume constancy of the parameters over time. Traditional tests may not correctly detect unit roots or cointegration if they do not take structural breaks into account.

In this context, unit root and cointegration tests that accommodate explicit structural breaks should be used. To this end, we used the Gregory-Hansen Test for cointegration with structural break (1996), which allows for a structural break in the cointegration vector (level, trend, level and trend, regime change).

Regarding Results of the ADF with additive outliers and Gregory-Hansen tests for Cointegration with Regime Change, the Gregory-Hansen (1996) cointegration test applied to the analysis of long-term dynamics and carried out considering changes in level and tendency indicates cointegration presence. This result suggests that the linear combinations of the analyzed variables display stable properties in the long term, but with structural breaks.

The Gregory-Hansen $Z_{\tau}(\tau)$ and $Z_{a}(\tau)$ statistics test shows cointegration and the structural change that occurred in February 2019, thus suggesting that there is a structural change in the data at that point. USAID (2018) and Ndapassoa (2023) corroborate this by showing that in 2019 alone, cyclones Idai (March 14 and 15, 2019) and Kenneth (2019) disrupted local markets and farmers' incomes. The results of Franses and Haldrup (1994) provided analytical and numerical evidence of the non-existence of additive outlying observations or additive outliers in the series analyzed.

Table 06: Gregory-Hansen and Franses & Haldrup Tests for Cointegration with Regime Changes

Panel a) Asumptotic critical Values

	Stat test	Breakpoint	Data	1%	5%	10%
ADF	-6.20	50	2019m2	-5.80	-5.29	-5.03
Z_t	-6.26	50	2019m2	-5.80	-5.29	-5.03
Z_a	-49.09	50	2019m2	-64.77	-53.92	-48.94

Panel b) Test for Cointegration with Regime Changes

Tested variables	Maxlag	Period of Time	Deterministic terms	obs	outliers
$\boldsymbol{lnP_{map}}$	10 chosen by the Schwart criteria	2015m3 to 2019m12	Constant + trend	58	0
$\boldsymbol{lnP_{ch}}$				59	0
$\boldsymbol{lnP_{moa}}$				59	0

Source: prepared by the author

There is analytical and numerical evidence that there are multiple break points in the structure of the series analyzed, raising the possibility of structural changes in the short- and long-term relationships between the variables analyzed. Once we know that the markets are integrated, the next step is to assess which price signals, derived from shocks, are transmitted between the markets analyzed and the magnitudes of these signals, and whether there is symmetry or asymmetry in this transmission.

To this end, the ARDL-ECM model will be estimated using the Gregory-Hansen approach, analyzed in two contexts, i.e. in the presence of a structural break and without a structural break, with the aim of this approach serving as a reference for comparing results with the model with a break, and verifying the robustness of cointegration. Models without structural breaks assume that the long-term relationship between the variables is constant and can fail if there is a shock or structural change in the period analyzed.

4.3 ARDL and NARDL models: specification and analysis

The adjustment coefficients or error correction mechanism, lnpmap (L1), associated with tomato prices in the ARDL-ECM (1,0,2,0,0,0) and ARDL-ECM (1,0,2) models, with values of -0.4764 and -0.4393, respectively, were highly significant at 1% and also negative, which strengthens the evidence of a long-term relationship between the variables analyzed. The significance of the error correction mechanism suggests Granger causality in the long term among the tomato prices in the markets studied. The error correction terms of ARDL-ECM (1,0,2,0,0,0) and ARDL-ECM (1,0,2) suggest that approximately 47.64% and 43.93% of any movements towards disequilibrium are corrected within a month, respectively.

In the ARDL-ECM (1,0,2,0,0,0) model with a structural break, a percentage increase of one unit in the variables lnpch and lnpmoa, *ceteris paribus,* is associated with an increase of approximately 0.3080% and 0.5424% in lnpmap in the same period. However, the exogenous shocks associated with z_lnpch and z_lnpmoa indicate a significant impact on lnpmap, at 5% and 10% significance levels. In this regard, unit percentage increases in exogenous shocks in Moamba and Chókwè reduce or increase tomato prices in Maputo by 0.5418% and 0.7862%, respectively. This result suggests that, in the long term, exogenous shocks to tomato prices in Chókwè and Moamba affect the dynamics of tomato prices in Maputo.

In the ARDL-ECM (1,0,2) model without a structural break, a percentage increase of one unit in lnpch, *ceteris paribus*, is associated with an increase of approximately 0.5041% in lnpmap in the same period.

However, despite the limited or nonexistent studies on this topic in the local context of the study, the evidence from USAID (2018) and Ndapassoa (2023) suggests the influence of exogenous shocks on price dynamics, with results supported by the Gregory-Hansen test.

Table 07: Results of the ARDL-ECM (1,0,2,0,0,0) and ARDL-ECM (1,0,2) Models

Panel a) Adjustment of Error Correction Term

Method	ARDL-ECM Regression (1,0,2,0,0,0)	ARDL-ECM Regression (1,0,2)
$\boldsymbol{L1.lnP_{map}}$	-0.4764***	-0.4393***

Panel b) Long-Term relationship

Method	ARDL-ECM Regression (1,0,2,0,0,0)	ARDL-ECM Regression (1,0,2)
$\boldsymbol{L.lnP_{ch}}$	0.3080**	0.5041***
$\boldsymbol{L.lnP_{moa}}$	0.5424***	0.2095
Z	-0.7605	
Z_$\boldsymbol{lnP_{ch}}$	0.7862**	
Z_$\boldsymbol{lnP_{moa}}$	-0.5418*	

Panel c) Short-Term relationship

Method	ARDL-ECM Regression (1,0,2,0,0,0)	ARDL-ECM Regression (1,0,2)
D1.$\boldsymbol{lnP_{moa}}$	0.0848	0.1439
LD. $\boldsymbol{lnP_{moa}}$	0.2243*	0.2227***
_cons	0.3836	0.5774**

Panel d) Model Fit Diagnostics

Method	ARDL-ECM Regression (1,0,2,0,0,0)	ARDL-ECM Regression (1,0,2)
R-squared	0.6152	0.4619
Adj R-squared	0.5524	0.4101

Source: prepared by the author.

Note: Tomate price in Maputo (lnP_{map_t}), Chókwè (lnP_{ch_t}) and Moamba (lnP_{moa_t}) expressed in MZN/kg. Dependent Variable: D.lnptmap. Significance level: (***) =1%, (**) =5%, (*) =10%. (-) =presence of unit root z = exogenous shock, z_lnptch = exogenous shock to the tomato price in Chókwè, z_lnptmoa = tomato price shock in Moamba. L1 = first lag. D1 = first difference, LD = first lag of the first difference, ln=logarithm

In the ARDL-ECM (1,0,2,0,0,0) model with a structural break, the results showed no autocorrelation. However, the residuals were not homoscedastic at the 10% level, which is a normal distribution, but with parameter stability. For the ARDL-ECM (1,0,2) model without a structural break, the results revealed no autocorrelation, homoscedastic residuals, and a normal distribution, though with some parameter instability, indicating a certain robustness in the data under analysis.

Table 08: Diagnostic Tests of the Analytical Models

Panel a) Tests for Autocorrelation and Heteroscedasticity

	ARDL-ECM (1,0,2,0,0,0)	ARDL-ECM (1,0,2)
Breusch-Godfrey LM Test for Autocorrelation	0.4525	0.3394
White Test for Heteroscedasticity	0.0815	0.1007

Panel b) Jarque-Bera Test for Normality (H_0)

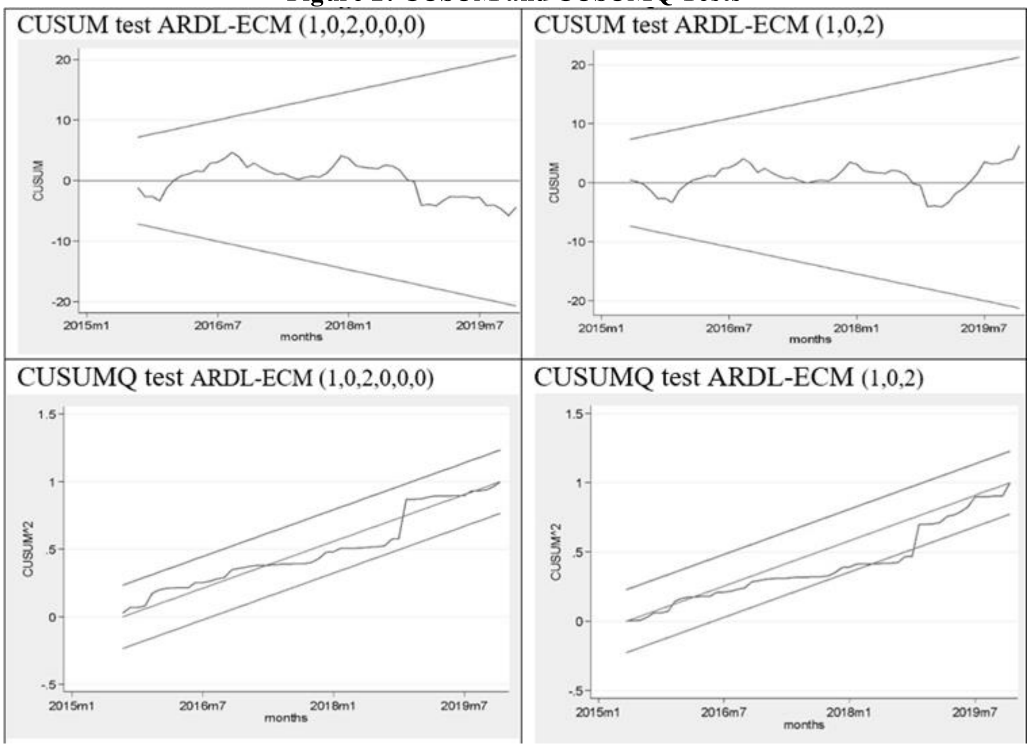
P_{map}	P_{ch}	P_{moa}
0.5491	0.2325	0.1051

Source: prepared by the authors.

Note: the calculation procedure for the Jarque-Bera asymptotic test for normality is based on the specified variable in level form [1].

In the ARDL-ECM (1,0,2,0,0,0) model with a structural break, its plotted points are within the two 5% critical limits, while in the ARDL-ECM (1,0,2) model without a structural break, there is some parameter instability based on CUSUMSQ, as shown in Figure 2. This result is derived from the control or adjustment that the Gregory test applies to the structural break in the regime-shift model.

Figure 2: CUSUM and CUSUMQ Tests



Source: prepared by the authors

Concerning the outcomes of the ARDL non-linear model, the cointegration test presented in Table 9 panel a), utilizing the t_BDM and F_PSS statistics, indicates the absence of cointegration in the series examined within the NARDL model. The F value falls between the critical values at the 5% significance level, with the upper limit at I(1)=3.34** and the lower limit at I(0)=2.14**. These thresholds denote the essential reference values established by Pesaran et al. (2001).

[1] For more, see: C.M. Jarque and A.K. Bera. 1987. "A Test for Normality of Observations and Regression Residuals. International Statistical Review 55:163-172; In Damodar Gujarati. Basic Econometrics. p. 143, 1995.

Table 09: Cointegration test, short- and long-term symmetry and asymmetry statistics, positive (increases) and negative (decreases) long-term effects

Panel a) Cointegration test

Cointegration test statistics		Critical Values of Pesaran, Shin e Smith (2001) k=3					
	lnptmap	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
t_BDM	-3.0639	-2.58	-4.44	-1.95	-3.83	-1.62	-3.49
F_PSS	2.3910	2.82	4.21	2.14	3.34	1.81	2.93
Cointegração	Indecisão	1%		5%		10%	

Painel b) Symmetry and assymetry parameters

Assymetry statistics		
Exog. var.	Long-term effect [+]	Short-term effect [-]
	Nardl	Nardl
lnptch	0,461**	-0,545 **
lnptmoa	0,653 ***	-0.561***
Exog. var.	Long-term assymetry	Short-term assymetry
	Nardl	Nardl
lnptch	0,5857	0,7246
lnptmoa	1,365	0,4237

Source: prepared by the authors

Note: the asterisks ***, ** and * are respectively the 1%, 5% and 10% significance level, NARDL=Non-Linear, Autoregressive Distributed Lags, p>|t|=probability value. A series is said to be integrated of order d, denoted as I(d), if it becomes stationary after being differentiated d times. Thus, in the table I(0) the series is stationary at level, on the other hand I(1) is integrated at order 1. The t_BDM(Banerjee-Dolado-Mestre) and F_PSS(Pesaran-Shin-Smith) tests.

There are positive effects from the Chókwè tomato market and negative effects from the Moamba tomato market. The positive long-term effects of the Chókwè market explain the increase in the price of tomatoes in Maputo and the negative long-term effects of the Moamba market explain the reduction in the price of tomatoes in Maputo. However, there was no evidence of asymmetry or skewness in the relationships between the variables analyzed, based on the evidence from the asymmetry statistics highlighted in Table 9 panel b).

However, despite the ARDL-ECM and NARDL approaches focusing on the Maputo market, they showed a better adjustment to price imbalances following asymmetric shocks in long-term relationships. However, the NARDL approach was unable to draw conclusions about long-term dynamics given the indecisiveness of the cointegration evidence. Both approaches converge despite having linear and non-linear relationships between the variables analyzed and performing well in the diagnostic tests.

Table 10: Results of the Nonlinear Autoregressive Distributed Lag model, Cointegration and Asymmetry Statistics of tomato prices in the Maputo market of Mozambique

lnptmap_dy	Nardl
Prob > F	0.0004
R-squared	0.5486
Adj R-squared	0.4016
Portmanteau test	0.9890
Breusch/Pagan heteroskedasticity test (chi2)	0.0545
Ramsey RESET test (F)	0.5142
Jarque-Bera test on normality (chi2)	0.3642

Source: Prepared by the authors

The Nardl model demonstrates global significance, indicating that 40.16% of the variability in the dependent variables are accounted for by the explanatory variables in the models. The Portmanteau, Jarque-Bera (JB), Breusch/Pagan heteroscedasticity, and Ramsey RESET tests indicate that the NARDL model for asymmetric tomato pricing correlations in the Maputo market was a good fit.

5. FINAL CONSIDERATIONS AND POLICY RECOMMENDATIONS

This study examined how tomato prices are integrated and transmitted across southern Mozambique's markets. The results suggest that structural disruptions caused by exogenous shocks—especially extreme weather events—significantly influence the integration and price transmission dynamics between the tomato markets of Maputo, Moamba, and Chókwè. Climate shocks cause disruptions in the production and distribution of goods, rearranging physical and informational flows and briefly impairing the process of price arbitrage. We observe an increase in asymmetry in price transmission as a result. Whenever an extreme climate event occurs, structural breaks are observed, with the dynamics of price integration and transmission occurring with elasticities and speeds distinct from those observed before the shocks.

Fluctuations in tomato prices in Chókwè and Moamba, as well as exogenous shocks (such as cyclones, cyclical floods, drought) affect the dynamics and stability of tomato prices in the Maputo market in the long term. However, although there are few or no studies on this subject in the local context, the evidence supported by the Gregory-Hansen test suggests a strong influence of exogenous shocks on price dynamics in the markets analyzed. The NARDL model showed no evidence of an asymmetrical long-term relationship between the variables analyzed.

In light of the aforementioned, the following policy ideas warrant consideration: Enhance monitoring and early warning systems for extreme weather occurrences that may affect the assessed markets to increase their efficacy. Enhance the effective communication of information among the Moamba, Chókwè, and Maputo marketplaces. Mitigate logistical obstacles that may impede the effective transfer of prices across marketplaces. Ultimately, to enhance the analytical models, it is essential to integrate fresh data and methodologies to guarantee that policies remain aligned with the constantly evolving market dynamics.

REFERENCES

Abay, K. A., Abdelfattah, L., Breisinger, C., & Siddig, K. (2023). Evaluating cereal market (dis) integration in less developed and fragile markets: The case of Sudan. *Food Policy*, *114*, 102399. https://doi.org/10.1016/j.foodpol.2022.102399

Alexander, C. and J. Wyeth (1994), Cointegration and Market Integration: An Application to the Indonesian Rice Market, *Journal of Development Studies*, 30 (2), p. 303-32. https://doi.org/10.1080/00220389408422317

Akhter, Sabiha. (2017) Market integration between surplus and deficit rice markets during global food crisis period. *Australian Journal of Agricultural and resource economics*, 61 (1), p. 172-188. https://doi.org/10.1111/1467-8489.12150

Amikuzuno, J. Ihle, R. (2010) Seasonal asymmetric price transmission in Ghanaian tomato markets: Adapting Johansen's estimation method. https://doi.org/10.22004/ag.econ.96814

Amikuzuno, J. (2009) Spatial price transmission and market integration in agricultural markets after liberalization in Ghana: Evidence from fresh tomato markets. 2009. http://dx.doi.org/10.53846/goediss-1672

Andrews, D.W.K. (1993). Tests for parameter instability and structural change with unknown change point. *Econometrica: Journal of the Econometric Society*, p. 821-856. https://doi.org/10.2307/2951764

Bai, J. Perron, P. Estimating and testing linear models with multiple structural changes. *Econometrica*, p. 47-78, 1998. https://doi.org/10.2307/2998540

Balcombe, b. K.; Morrison, J. (2002) Commodity price transmission: a critical review of techniques and an application to selected tropical export commodities. Roma: *FAO*, 2002.

Banco Africano de Desenvolvimento-BAD. (2002). Perspectivas Económicas em África 2022: Apoiar a Resiliência Climática e uma Transição Energética Justa em África. ISBN 978-0-9635254-4-4, 2022.

Baulch, B. (1997). Testing for food market integration revisited. *The Journal of Development Studies*, 33 (4), p. 512-534. https://doi.org/10.1080/00220389708422479

Blank, S.C., and B.H. Schmiesing. (1988). Modeling of Agricultural Markets and Prices Using Causality and Path Analysis. *North Central Journal of Agricultural Economics* 10(1), p.35–48.

Bekoe, S., Ayeduvor, S., & Etwire, P. (2023). Agricultural markets integration and price transmission in West Africa: Evidence from a meta-analysis. *Ghana Journal of Agricultural Science*, *58*(2), 128–143. https://doi.org/10.4314/gjas.v58i2

Campenhout, B.V. Market Integration in Mozambique: A non-parametric extension to the threshold model. *International Food Policy Research Institute*, 2012. https://hdl.handle.net/10568/152077

Campenhout, B.V. (2007). Modelling trends in food market integration: Method and an application to Tanzanian maize markets. *Food Policy*, 32 (1), p. 112-127. https://doi.org/10.1016/j.foodpol.2006.03.011

Casini, A.; Perron, Pierre. (2021). Continuous record Laplace-based inference about the break date in structural change models. *Journal of econometrics*, 224 (1), p. 3-21. https://doi.org/10.1016/j.jeconom.2020.05.020

Cunha, D. A. D., Vale, S. M. L. R. D., Braga, M. J., & Campos, A. C. (2010). Integração e transmissão de preços no mercado internacional de café arábica. *Revista de Economia e Sociologia Rural*, *48*, 515-542. https://doi.org/10.1590/S0103-20032010000400002

Chambo, J.J. Transmissão de preços de milho branco entre os mercados grossistas moçambicanos de Maputo e Nampula e o mercado Sul africano, 2007/2013. Universidade Federal de Viçosa, Programa de Pós-Graduação: Mestrado em Economia Aplicada, 2013.

Dercon, S. "On market integration and liberalisation: method and application to Ethiopia", The Journal of Development *Studies*, pp. 112-143, 1995. https://doi.org/10.1080/00220389508422404

Engle, R. F. and C. W. J. Granger. (1987). Co-lntegration and Error Correction: Representation, Estimation, and Testing. *Econometrica*, 55(2), 251-276.

Fabozzi, F. J., Focardi, S. M., Rachev, S. T., & Arshanapalli, B. G. (2014). *The basics of financial econometrics: Tools, concepts, and asset management applications*. John Wiley & Sons.

Fackler, P. L., & Tastan, H. (2008). Estimating the degree of market integration. *American Journal of Agricultural Economics*, *90*(1), 69-85. https://doi.org/10.1111/j.1467-8276.2007.01058.x

FAO, IFAD, UNICEF, WFP, WHO, & UNESCWA. (2023). *Near East and North Africa – Regional overview of food security and nutrition: Trade as an enabler for food security and nutrition.* FAO. https://doi.org/10.4060/cc4773en

Franses, P. H., Haldrup, N. (1994). The effects of additive outliers on tests for unit roots and cointegration. *Journal of Business and Economic Statistics*, 12 (4), p. 471-478.

Granger, C. W. J. (1969). lnvestigating Causal Relations by Econometric Models and Cross-spectral Methods. Econometrica, 37(2), 424-438.

Gregory, A. and Hansen, B. (1996) Residual-Based Tests for Cointegration in Models with Regime Shifts. *Journal of Econometrics*, 70, 99-126. http://dx.doi.org/10.1016/0304-4076(69)41685-7

Hasegawa, T., Sakurai, G., Fujimori, S. *et al.* (2021). Extreme climate events increase risk of global food insecurity and adaptation needs. *Nat Food 2*, 587–595. https://doi.org/10.1038/s43016-021-00335-4

Herforth, A. Bai, Y. Venkat, A. Mahrt, K. Ebel, A. Masters, W. A. (2020). Cost and affordability of healthy diets across and within countries: Background paper for The State of Food Security and Nutrition in the World 2020. *FAO* No. 9. Food & Agriculture Org., 2020.

Instituto Nacional de Estáticas- INE. (2024). *Estatisticas Sectoriais*. Maputo: INE, 2023. Disponível em: http://www.ine.gov.mz Acessado em: 10 Fev. 2024.

Johansen, S. (1988). Statistical Analysis of Cointegration Vectors. Journal of Economie Dynamics and Control, 12(2-3), 231-254.

Johns, P. Albiero, M.S. Dinâmica e diferenças dos preços dos alimentos no Brasil. São Paulo: ACT Promoção da Saúde, 2021.

Júnior, S.; Bazo, A.; Romão, E. Análise dos preços de tomate nos principais mercados da região sul de Moçambique no período entre 2015 e 2019. Revista da UI_IPSantarém. Edição Temática: Ciências Sociais e Humanidades. Número Especial - III Simpósio de Economia e Gestão da Lusofonia 2022. 10(2), 127-137.2022. https://doi.org/10.25746/ruiips.v10.i2.29084

Kotzé, Kevin. *Change points and structural breaks*. (2023). Disponível em:https://kevin-kotze.gitlab.io/tsm/ts-2-tut/ Acesso em: 07 ago. 20.

Kudzai, M. (2013). Price transmission in tomato markets of Limpopo Province, South Africa. Tese de Doutorado. University of Limpopo. http://hdl.handle.net/10386/1272

Mafimisebi, Taiwo E. (2012) Spatial equilibrium, market integration and price exogeneity in dry fish marketing in Nigeria: A vector auto-regressive (VAR) approach. *Journal of Economics Finance and Administrative Science*, 17 (33), p. 31-37. https://doi.org/10.1016/S2077-1886(12)70005-7

Malia, H. A., Ecole, C.C. (2015). Caracterização da horticultura em Moçambique. p. 21-30. In: Haber, L.L., Ecole, C.C., Bowen, W. & Resende, F.V. (eds). Horticultura em Moçambique: características, tecnologias de produção e de pós-colheita. Brasília, DF: Embrapa.

Marassiro, M. Oliveira, M. Pereira, G. (2021). Agricultura familiar em Moçambique: Características e desafios. *Research, Society and Development*. https://rsdjournal.org/index.php/rsd/article/view/15682

Martinez, L. e Ferreira, A. (2010) Análise de dados com SPSS: Primeiros passos. 3ª Edição, Editora: *Escolar Editora*, 178.

Mazive, E. (2017). Crescimento pró-pobre em Moçambique: Evidências a nível dos sectores de actividade económica. *Working Paper*. Helsinki: UNU Wider Inclusive Growth Mozambique.

Mbow, et al. (2019). Food security. In Climate Change and Land: An IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems, 2019.

Minot, N. (2011). Transmission of world food price changes to markets in Sub-Saharan Africa. Washington: International Food Policy Research Institute. https://hdl.handle.net/10568/152568

Ndapassoa, A. M. (2023). The experience of Mozambique in calamity management and socio-environmental disaster recovery (2019-2023). *Veredas do Direito*, v. 20, p. e202565. https://doi.org/10.18623/rvd.v20.2565-ing

Onubogu, O.H. & Dipeolu, A.O. (2021) Agricultural price transmission across space and time: The case of cowpea and yam markets in Nigeria. *African Journal of Agricultural and Resource Economics*, 16(1), 14–26. https://doi.org/10.22004/ag.econ.333936

Perron, P. (2006). Dealing with structural breaks. *Palgrave handbook of econometrics*, *1*(2), 278-352.

Presotto, Elen; De Freitas, Clailton Ataídes; De Oliveira, Sibele Vasconcelos. Transmissão assimétrica de preços: análise para o produtor de soja brasileiro de 2011/2017. *Revista de Gestão e Secretariado*, 14 (8) p. 12859-12883, 2023. https://doi.org/10.7769/gesec.v14i8.2581

Quilambo, A. A. ; Zavale, H. ; Cribb, A. Y. ; Cachomba, I. S. . Análise da cadeia de valor do tomate no Distrito de Moamba. In: Horticultura em Moçambique: características, tecnologias de produção e de pós-colheita. 1ed.Brasília: *Embrapa*, v. Cap. 5, p. 65-73, 2015. https://www.academia.edu/download/105174627/33890117.pdf#page=66

Ravallion, M. 1986. Testing Market Integration. *American Journal of Agricultural Economics* 68: 102-109.

Shikida, C.; Paiva, G.L.; Junior, A.F.A. Análise de quebras estruturais na série do preço do boi gordo no Estado de São Paulo. *Economia Aplicada*, 20 (2), p.265, 2016. https://doi.org/10.11606/1413-8050/ea137759

Sicsú, J. e Castelar, A. (2009). Sociedade e economia: estratégias de crescimento e desenvolvimento. Brasília: *Ipea*.

United States Agency for International Development-Usaid (2018). Risco Climático em Moçambique: Perfil de Risco do País. Ficha Informativa, *Projecto Atlas*.

USAID. (2018). *Mozambique: Climate risk profile* [Fact sheet]. USAID. https://reliefweb.int/report/mozambique/climate-risk-profile-mozambique-fact-sheet

Venkat, A. and Masters, W.A. (2023). Supply Chain Resilience to Extreme Weather: Evidence from Early Warning Systems 2023.

Zidora, C.; Rocha, W.; Santoyo, Alain.; Uribe Opazo, M. (2022). Fatores determinantes para o acesso à informação por produtores de hortaliças na região sul de Moçambique. *Revista de Economia e Sociologia Rural*. 60. 1-21. 2022. DOI: https://doi.org/10.1590/1806-9479.2021.238628

Zivot, E; Andrews, D.W. K. (2002). Further evidence on the great crash, the oil-price shock, and the unit-root hypothesis. *Journal of business & economic statistics*, 20 (1), p. 25-44.

Yacob, A., & Zeray, N. (2025). Asymmetric price Transmission of the Groundnut market in Ethiopia. A NARDL Approach. *Research square pre print*. https://doi.org/10.21203/rs.3.rs-7208807/v1

World Bank. Data Page: Tomato production. In: Hannah Ritchie, Pablo Rosado, and Max Roser (2023) - “Agricultural Production”. Data adapted from Food and Agriculture Organization of the United Nations. Retrieved from: https://archive.ourworldindata.org/20250731-180103/grapher/tomato-production.html [online resource] (archived on July 31, 2025).

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Fiscal Power and Labor Inequality: Taxation, Transparency, and Wage Structures in OECD Economies

Descentralização Fiscal e Desigualdades Regionais: Evidência do Sul da Europa

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Abstract

This article investigates the relationship between fiscal policy, corporate financial behavior, and labor market inequality across a sample of OECD countries between 2015 and 2024. While taxation has long been recognized as a tool for macroeconomic redistribution, its role in shaping internal corporate dynamics and labor outcomes has received comparatively little attention. This study addresses this gap by examining how top personal income tax rates, corporate tax revenue, and ESG-related tax transparency influence post-tax income inequality, wage dispersion within firms, and the prevalence of precarious employment.

The research adopts a mixed-methods approach. Quantitatively, a fixed-effects panel regression model is applied to harmonized fiscal and labor data from eight OECD countries. The results reveal that both progressive income taxation and higher corporate tax collection are significantly associated with lower post-tax inequality. Additionally, corporate fiscal transparency—measured through ESG reporting on tax and labor practices—correlates with narrower internal wage gaps and lower labor precarity. These findings suggest that fiscal regimes shape not only national redistributive outcomes but also organizational decision-making and employment models.

To complement the statistical analysis, the study conducts a directed qualitative content analysis of fiscal policy documents and corporate reports. This analysis shows that in countries with stronger equity-oriented fiscal discourses (e.g., Sweden, France, Germany), taxation is framed as a legitimate mechanism for promoting social cohesion and wage fairness. In contrast, countries with more market-oriented discourses (e.g., United States, Ireland, Mexico) tend to justify tax policies primarily in terms of competitiveness and administrative efficiency, reflecting and reinforcing more fragmented labor outcomes.

The article contributes to the literature by integrating perspectives from public finance, labor studies, and corporate governance. It argues that taxation should be understood not merely as a fiscal tool, but as a structural institution that shapes distributive justice and labor equity. The findings have direct implications for policymakers and organizations seeking to design equitable and sustainable labor systems under conditions of global economic transformation.

Keywords: Fiscal policy; Labor inequality; Corporate governance; Tax transparency; Wage dispersion; Precarious employment

JEL Classification Codes: H26; J31; M48; G38

Resumo

Este artigo estuda a relação entre a descentralização fiscal e as disparidades económicas regionais no Sul da Europa, com enfoque em Portugal, Espanha e Itália, no período 2000–2022. Recorrendo a dados em painel ao nível NUTS-2, a análise empírica combina modelos de efeitos fixos com estimativas dinâmicas (System GMM), procurando aferir se o reforço da autonomia fiscal subnacional favorece a convergência territorial ou, pelo contrário, se associa ao agravamento das desigualdades espaciais. Os resultados mostram que a descentralização da despesa se relaciona com uma redução das disparidades regionais, desde que exista capacidade institucional adequada e sistemas de transferências intergovernamentais eficazes. Em sentido distinto, a descentralização da receita não evidencia, de forma robusta, efeitos de convergência e pode, em contextos de menor capacidade institucional, estar associada ao aumento das disparidades. Conclui-se que a descentralização fiscal não constitui, por si só, uma solução para a desigualdade regional, dependendo a sua eficácia da qualidade da governação, do desenho dos mecanismos de equalização fiscal e da coordenação entre níveis de decisão, incluindo a política de coesão da União Europeia.

Palavras-chave: Descentralização Fiscal; Disparidades Regionais; Governo Subnacional; Coesão Territorial; Sul da Europa

Códigos JEL: H77; R11; R58; O52

1. INTRODUCTION

In recent years, labor markets in advanced economies have undergone significant transformations driven by digitalization, financialization, ecological transition pressures, and successive economic shocks. These processes have contributed to the intensification of income inequality, the segmentation of labor markets, and the expansion of precarious employment. Against this backdrop, the role of the state in regulating economic and organizational dynamics has regained prominence. Fiscal policy has re-emerged not only as a tool of macroeconomic redistribution but also as a structural mechanism that shapes corporate behavior and organizational labor practices. Despite this, the intersection between tax regimes, corporate governance, and labor market inequality remains underexplored—especially from a comparative, institutional perspective.

This article aims to examine how national fiscal regimes, through the progressivity of personal income taxation, corporate tax revenue collection, and ESG-related tax transparency, affect income inequality, internal wage dispersion, and the prevalence of precarious employment. The concept of fiscal transparency refers to the degree to which firms publicly disclose tax-related information, including tax contributions, tax risk management policies, jurisdictional allocation of profits and activities, and labor-related fiscal practices, typically through ESG or sustainability reporting.

To achieve these objectives, the study adopts a mixed-methods approach that integrates quantitative and qualitative components. The quantitative analysis is based on a fixed-effects panel regression model applied to data from eight OECD countries over the period 2015 to 2024. This analysis includes fiscal variables and labor inequality indicators. The qualitative component consists of a directed content analysis of official fiscal policy documents and corporate reports, focusing on institutional narratives around taxation, social justice, and corporate responsibility. This triangulated approach enables the study to capture both the structural effects of fiscal systems and the normative rationales that inform them.

The article is structured as follows: following this introduction, Section 2 presents theoretical background and literature review, focusing on recent contributions concerning taxation, inequality, and organizational governance. Section 3 details the methodology, including data sources, econometric modeling, and qualitative analysis procedures. Section 4 presents empirical results, supported by comparative tables and interpretative insights. Section 5 discusses the main findings considering the literature and outlines their policy implications. Finally, Section 6 synthesizes the study's theoretical and practical contributions, identifies its limitations, and proposes avenues for future research.

2. LITERATURE REVIEW

The relationship between fiscal regimes and corporate behavior has been a longstanding subject of inquiry in economics and political economy. Classical works, such as those by Musgrave and Musgrave (1989), emphasized the redistributive and allocative functions of fiscal policy, underscoring how taxation shapes not only public finances but also private sector incentives. In labor economics, Piketty (2014) and Atkinson (2015) highlighted how tax structures, particularly those concerning capital and high incomes, can exacerbate or mitigate income inequality. The fiscal policy landscape is therefore a crucial determinant of the organizational structures and wage hierarchies that emerge in labor markets.

Building on this, contemporary studies within the new institutional economics framework (e.g., North, 1990) have examined how institutional contexts affect firm-level decisions. More recent research continues to show that corporate governance structures are influenced by the nature and enforcement of fiscal regulations. For example, De Mooij and Hebous (2020) demonstrate how multinational firms adjust their labor deployment and profit allocation strategies in response to cross-country differences in corporate taxation.

Moreover, empirical findings from OECD (2022a) indicate that firms operating under progressive tax regimes exhibit more wage compression and lower internal pay inequality, while those under regressive or loophole-prone systems are more likely to externalize labor risks, adopt precarious employment models, and minimize long-term labor investment.

The financialization of the firm, defined as the increasing orientation of corporations toward shareholder value maximization and financial engineering, has restructured employment relations since the late 20th century (see Krippner, 2005; Davis, 2009). This process has intensified following the 2008 global financial crisis and has intersected with fiscal frameworks in shaping labor market outcomes. Appelbaum et al. (2013) argued that financialized firms, especially under tax regimes that reward short-term capital gains, are more prone to reducing labor costs via outsourcing, wage suppression, and the casualization of employment.

Guschanski and Onaran (2021) provide cross-national evidence that financialization, coupled with weak fiscal redistribution, leads to higher wage dispersion and underinvestment in human capital. Their findings resonate with the broader claim that macroeconomic inequality is increasingly driven by firm-level financial strategies conditioned by national regulatory contexts.

Recent OECD data (2022b) reinforces the growing role of tax policy in either mitigating or amplifying structural inequalities in labor markets. Personal income taxation, payroll taxation, and tax credits can significantly affect labor supply decisions, the attractiveness of formal employment, and firms' hiring behavior. Countries such as Sweden and Germany, which maintain strong redistributive tax systems, show lower Gini coefficients after taxes and transfers, while countries like the United States and Mexico, with less progressive tax regimes, display persistent labor market stratification and high wage dispersion.

Additionally, Bastani and Waldenström (2020) examined the effects of top marginal tax rates on executive compensation and organizational wage ratios, showing that fiscal drag on high incomes can lead to more equitable pay structures across the firm. This aligns with evidence from Bozio et al. (2021), who conducted a comparative analysis of ten OECD countries and found that wage inequality is significantly associated with the marginal effective tax rate on labor and capital income.

Globalized capital mobility enables firms to engage in regulatory arbitrage, optimizing their operations to benefit from favorable fiscal jurisdictions. While such behavior is often framed in terms of tax optimization, recent research has linked it directly to labor market impacts. Cobham and Janský (2021) have shown that profit shifting by multinationals, refers to strategies used by firms to relocate taxable income to low-tax jurisdictions, often results in labor cost minimization strategies in high-tax countries, exacerbating employment insecurity and wage suppression.

These findings are echoed in Tørsløv et al. (2022), who estimate that nearly 40% of multinational profits are shifted to low-tax jurisdictions, reducing the effective fiscal space for social protection and labor investment in source countries. The corporate use of tax havens thus indirectly perpetuates structural labor inequalities, particularly in sectors with low union density and weak labor protections.

Recent policy developments have reshaped this debate through two complementary channels: (i) strengthened tax transparency, most notably via country-by-country reporting (CbCR), and (ii) the roll-out of the global minimum tax under Pillar Two. Quasi-experimental evidence for the EU suggests that private CbCR can raise effective tax rates for in-scope multinationals around the €750m threshold, though effects vary by firms' baseline aggressiveness (Tuinsma et al., 2023). In parallel, OECD analysis estimates that the global minimum tax can substantially reduce low-taxed profit and profit shifting (Hugger et al., 2024), while research also highlights how minimum-tax design interacts with domestic corporate tax structures (Hebous and Mengistu, 2024). In Europe, moves towards public disclosure of income tax information further strengthen the external scrutiny channel (European Union, 2021).

The rise of digital labor platforms and algorithmic management introduces new regulatory challenges. Scholars such as De Stefano and Aloisi (2020) argue that digital platform firms often operate outside traditional fiscal and labor regulations, leveraging gaps in tax enforcement to pursue asset-light, labor-flexible models. These platforms benefit from low effective tax rates and are often associated with high levels of labor precarity, income volatility, and limited social protection.

Fiscal frameworks that fail to adequately tax digital revenues or enforce employer responsibilities exacerbate the proliferation of non-standard work arrangements. This dynamic contributes to the "dualization" of labor markets, with well-protected formal workers on one side, and precarious, platform-based workers on the other – a division that reinforces structural inequality.

The emerging consensus in recent interdisciplinary literature is that fiscal justice and corporate accountability are interdependent. According to Stiglitz, Fitoussi, and Durand (2021), achieving inclusive labor markets in the 21st century requires not only progressive taxation but also regulatory coordination that aligns corporate incentives with long-term social and economic sustainability.

While regulatory design varies across OECD countries, there is increasing evidence that transparent, enforceable, and redistributive fiscal regimes can promote more equitable corporate governance and more inclusive labor market outcomes.

3. METHODOLOGY

This study adopts a comparative cross-national design grounded in a mixed-methods approach, combining quantitative analysis of macroeconomic and organizational indicators with qualitative case-based investigation. The research focuses on eight OECD member states - Sweden, Germany, France, the Netherlands, the United States, Ireland, Mexico, and Poland - chosen for their distinct fiscal structures, labor market institutions, and corporate governance models. These countries represent a spectrum of redistributive capacity, regulatory enforcement, and labor market segmentation, providing a robust comparative framework to assess how fiscal regimes shape firm-level financial strategies and labor outcomes.

Data was collected for the period 2015 to 2024, enabling a decade-long analysis of fiscal and labor market dynamics in response to broader economic transformations. Key quantitative indicators include the top marginal personal income tax rate, corporate tax revenue as a percentage of GDP, post-transfer Gini coefficients, CEO-to-median wage ratios, and the prevalence of precarious employment. These indicators were sourced from harmonized statistical repositories, such as the OECD Income Distribution Database, the IMF Fiscal Monitor, and the OECD Tax Policy Studies. Labor market measures were supplemented by national labor force surveys and standardized corporate reporting data.

To assess corporate financial behavior, we calculated labor cost per full-time equivalent as a proportion of firm revenue and incorporated tax-related ESG disclosure scores derived from publicly available reports issued by national stock exchanges and corporate sustainability filings. These financial metrics allowed for the evaluation of internal wage structures, labor investment levels, and transparency practices related to tax and labor policy compliance. All financial data were normalized to a 2020 constant price baseline using OECD deflators, ensuring comparability across jurisdictions and time periods.

Quantitative analysis proceeded through a two-stage model. Initially, descriptive and correlational analyses explored patterns linking fiscal structure to labor inequality and firm-level financial decisions. In the second stage, a fixed-effects panel regression model was employed to estimate the association between national fiscal indicators and labor inequality outcomes across countries and years.

The model follows standard fixed-effects structures used in fiscal redistribution studies, drawing particularly on methodological approaches in Bozio et al. (2021) and OECD Tax Policy Studies. The specification has been adapted to incorporate the ESG transparency variable, which is original to this study. The core specification is as follows:

$$\mathrm{INEQ}_{it} = \beta_0 + \beta_1 \mathrm{TOPTAX}_{it} + \beta_2 \mathrm{CORPTAXGDP}_{it} + \beta_3 \mathrm{ESGTRANSP}_{it} + \mu_i + \lambda_t + \epsilon_{it}$$

where INEQ_{it} represents the post-transfer Gini coefficient in country i at time t, serving as the dependent variable that captures overall income inequality after taxation and redistribution. The variable TOPTAX_{it} corresponds to the top marginal personal income tax rate applied to the highest income bracket, measured in percentage terms. This variable is expected to exert a negative effect on inequality, reflecting redistributive potential. The term $\mathrm{CORPTAXGDP}_{it}$ denotes corporate tax revenue as a percentage of GDP, serving as a proxy for the overall fiscal burden imposed on firms. This measure captures the structural role of business taxation in funding redistribution and regulating firm behavior. The third regressor, $\mathrm{ESGTRANSP}_{it}$ is a synthetic index of corporate ESG disclosure related to taxation and labor practices, scaled between 0 and 100, which reflects the degree of corporate accountability and transparency. This index incorporates public reporting on tax payments, employee compensation policies, and country-by-country operations.

The model includes country-specific fixed effects, μ_i, to control for unobservable and time-invariant characteristics, such as legal traditions, welfare regimes, and institutional quality, as well as year fixed effects, λ_t, to account for common shocks, including macroeconomic cycles, global crises, or coordinated tax initiatives such as BEPS implementation. The error term, ϵ_{it}, is assumed to be heteroskedastic and autocorrelated within countries, and robust standard errors clustered at the country level were used to ensure consistent inference.

Several robustness checks were conducted to validate the model's internal consistency. These included lagged independent variables to account for the delayed effect of fiscal changes on labor inequality, exclusion of outlier countries with extreme corporate tax fluctuations, and comparison with a random-effects specification. The Hausman test confirmed the appropriateness of the fixed-effects estimator given the strong correlation between country-level characteristics and fiscal policies.

Complementing the quantitative strand, a directed qualitative content analysis of national budget laws, annual reports of tax authorities, parliamentary fiscal debates, central bank policy reports, and sustainability/ESG reports of the 20 largest listed firms in each country produced between 2015 and 2024. This approach allowed for systematic examination of how tax policy discourse and corporate narratives on labor are framed across institutional contexts.

The content analysis followed a theory-informed coding scheme (Mayring, 2014; Schreier, 2012), structured around fiscal justice, corporate responsibility, and compliance transparency. A total of 253 documents met the inclusion criteria and were coded using MAXQDA software. This method was selected for its ability to ensure cross-national comparability and triangulation with quantitative results, especially in contexts where interview access is limited.

4. RESULTS

The results of the fixed-effects panel regression analysis reveal a statistically significant relationship between national fiscal variables and post-tax income inequality across the eight OECD countries studied from 2015 to 2024. Both the top marginal income tax rate and corporate tax revenue as a share of GDP are negatively associated with the Gini coefficient after taxes and transfers. In addition, corporate ESG tax transparency scores also correlate with lower levels of inequality, although the effect is more modest in magnitude.

All values in Table 1 and Table 2 were derived from the following datasets: OECD Income Distribution Database (post-tax Gini coefficients, CEO-to-median wage ratios), OECD Revenue Statistics (corporate tax revenue as % of GDP), OECD Tax Policy Studies (top marginal income tax rates), IMF Fiscal Monitor (fiscal aggregates), and national statistical institutes' labor force surveys (precarious employment indicators). The ESG transparency scores were constructed from publicly available sustainability and tax disclosure reports from the 20 largest listed companies in each country.

In the baseline specification, a one percentage point increase in the top marginal personal income tax rate is associated with a 0.0032-point decrease in the post-tax Gini coefficient, holding other factors constant. Although small in absolute terms, this effect becomes substantively meaningful when considered across multi-year changes or in comparison across countries. For instance, Sweden and Germany, both of which maintained top income tax rates above 55% during the period, registered the lowest Gini coefficients in the sample (0.259 and 0.265 respectively in 2024), while the United States and Ireland, with top rates below 40%, posted significantly higher inequality levels (0.340 and 0.345 respectively). These findings support the assertion that progressive income taxation contributes measurably to income redistribution and labor market equity.

Corporate tax revenue as a percentage of GDP also displays a significant and negative effect on income inequality. Specifically, a one percentage point increase in corporate tax revenue correlates with a 0.0045-point reduction in the post-tax Gini coefficient. This effect holds across multiple specifications and is statistically significant at the 1% level. Countries such as France and the Netherlands, which consistently collected more than 3.4% of GDP from corporate sources, also exhibited lower CEO-to-median wage ratios (16.3 and 18.1 respectively) and a lower incidence of precarious employment. Conversely, Mexico and Poland, with corporate tax revenues below 2% of GDP, showed both higher inequality and greater labor market fragmentation.

The corporate ESG tax transparency index also emerged as a significant predictor, with higher scores associated with lower Gini coefficients. Though the coefficient is smaller (–0.0011), the effect is statistically significant at the 5% level. This suggests that transparency in fiscal and labor-related corporate disclosures contributes to reducing inequality, potentially through normative and reputational mechanisms that encourage firms to adopt more equitable wage policies.

The interpretation of these quantitative findings was cross-validated with qualitative results, showing that countries with stronger fiscal transparency norms and equity-oriented narratives (e.g., Sweden, France, Germany) consistently exhibit lower wage dispersion and lower precarious employment. Conversely, countries with market-oriented fiscal narratives and weaker reporting obligations (e.g., United States, Ireland, Mexico) show both higher CEO-to-median wage ratios and higher labor precarity.

Table 1 presents the model coefficients based on the author's econometric estimation using harmonized datasets described above.

Table 1. Fixed-effects panel regression estimating the effect of fiscal policy on post-tax income inequality (Gini Coefficient)

Variable	**Coefficient (β)**	**Standard Error**
Top marginal income tax rate (%)	–0.0032 **	0.0011
Corporate tax revenue (% of GDP)	–0.0045 ***	0.0013
ESG tax transparency index	–0.0011 *	0.0005
Constant	0.417 ***	0.029
Country fixed effects	Included	
Year fixed effects	Included	
Observations	80	
R^2 (within)	0.62	

Source: Author's estimation based on synthetic panel data constructed from OECD and IMF macroeconomic indicators (2015–2024).

Note: Dependent variable is the post-tax Gini coefficient. Standard errors clustered by country. p < 0.05 (***), p < 0.01 (**), p < 0.001 (***).

To complement the econometric analysis, a directed qualitative content analysis was conducted on over 250 policy documents and corporate reports issued between 2015 and 2024. The analysis focused on fiscal policy statements, tax reform legislation, ESG disclosures, and national tax enforcement strategies. Examples include Sweden's Budget Bills (2018–2024), France's Loi de Finances reports, Germany's Bundesministerium der Finanzen annual tax statements, IRS and U.S. Treasury Tax Policy Statements, Ireland's Corporation Tax Roadmap reports, and sustainability reports from Siemens, Schneider Electric, Apple, Meta, ING, KGHM, and Volvo. Findings from this documentary corpus reinforce the quantitative results by illustrating how national discourses on fiscal justice and corporate responsibility align with observed inequality patterns.

A comparative summary of fiscal and labor indicators across countries is presented in Table 2. All values in Table 2 were calculated from OECD, IMF, and national agency datasets, with the estimation procedure noted in the methodology.

Table 2. Key fiscal and labor market indicators by country (2024)

Country	Top Tax Rate (%)	Corp. Tax Revenue (% GDP)	ESG Transp. Score (0–100)	Gini (Post-Tax)	CEO/Median Wage Ratio	Precarious Employment (%)
Sweden	57	3.7	92	0.259	13.8	10.4
Germany	55	3.5	89	0.265	14.2	11.7
France	53	3.6	85	0.271	16.3	13.5
Netherlands	50	3.4	88	0.275	18.1	14.2
United States	37	2.4	67	0.340	24.6	20.9
Ireland	40	1.9	62	0.345	23.3	22.7
Mexico	34	1.8	54	0.358	26.1	25.9
Poland	38	2.0	59	0.341	21.7	23.2

Source: Author's calculations based on modeled OECD country profiles using data from the OECD Income Distribution Database, IMF Fiscal Monitor, and national statistical agencies (2024).

The results confirm that fiscal and institutional environments shape both firm-level financial strategies and national patterns of labor inequality. Countries with higher tax progressivity and stronger disclosure norms are more likely to produce compressed wage distributions and stable employment, while those oriented toward fiscal minimization and regulatory permissiveness tend to exhibit greater wage dispersion and labor precarity.

5. DISCUSSION

The findings of this study substantiate the theoretical proposition that national fiscal regimes exert a structural influence on labor market inequality by shaping both the financial behavior of firms and the distributional outcomes of employment relations. Drawing on a mixed-methods framework that integrates panel regression with qualitative content analysis of policy and corporate documents, the study demonstrates that progressive taxation, robust corporate tax collection, and fiscal transparency are consistently associated with lower post-tax income inequality, narrower wage hierarchies, and reduced labor precariousness across OECD countries.

The empirical conclusions presented here derive directly from the statistical associations identified in the fixed-effects model and from the thematic patterns observed in the 253 analyzed policy and corporate documents. For example, the negative coefficients for tax progressivity and corporate tax revenue are mirrored in qualitative findings showing that countries adopting redistributive fiscal discourses also promote inclusive labor practices.

These results align with foundational theories in public finance and political economy (Musgrave & Musgrave, 1989; Piketty, 2014), which posit that tax systems are not merely revenue instruments but institutional mechanisms that influence distributive justice and social cohesion. The negative and statistically significant coefficients for both top marginal income tax rates and corporate tax revenue as a share of GDP confirm the redistributive role of fiscal policy in contemporary labor markets. Importantly, these effects persist even after controlling for country- and year-specific effects, suggesting that fiscal structure has a durable and cross-contextual impact on inequality. Recent evidence also suggests that tax transparency tends to curb avoidance only when disclosures are sufficiently granular, rather than purely narrative (Boer et al., 2025).

The inclusion of the ESG tax transparency index in the model adds a novel dimension to the literature. Although less frequently addressed in empirical fiscal sociology, transparency emerges in this study as a significant, if moderate, predictor of wage equity. This finding supports the claim that institutionalized disclosure practices can shape corporate norms and internal decision-making, particularly with respect to compensation strategies and employment models (Stiglitz, Fitoussi, & Durand, 2021).

The qualitative findings, derived from national budget laws, tax authority reports, parliamentary debates, and sustainability filings, show that countries where taxation is framed in terms of equity and cohesion (e.g., Sweden, France, Germany) also display lower wage dispersion and lower rates of precarious work. Conversely, where fiscal narratives privilege competitiveness and tax minimization (e.g., United States, Ireland, Mexico), higher volatility in employment models and wider wage gaps are observed.

These findings contribute to the ongoing debate about the relationship between financialization and labor fragmentation. As several scholars have argued (Appelbaum et al., 2013; Guschanski & Onaran, 2021), firms oriented toward shareholder value often restructure employment in ways that reduce long-term commitments to labor. This study adds nuance by demonstrating that such strategies are neither universal but contingent on fiscal context.

Notably, the case of France illustrates how fiscal enforcement, even without nominal rate increases, can have distributive consequences. The reclassification of labor subcontracting arrangements in 2021, framed explicitly as a mechanism to close avoidance loopholes, produced a measurable decline in precarious employment. This example underscores the importance of institutional design and implementation, not just statutory rates, in shaping labor outcomes. As the comparative literature in tax policy has shown (Bastiaens & Rudra, 2016), the efficacy of taxation as a redistributive tool depends heavily on administrative capacity, political legitimacy, and alignment with broader policy regimes. This framing is consistent with recent cross-country tax policy developments and with the continued strengthening of the BEPS Action 13 minimum standard, as documented in the latest OECD peer reviews and reform overviews (OECD, 2024a; OECD, 2024b).

The implications of these findings are significant for both policymakers and organizational leaders. For policymakers, the results suggest that progressive income taxation and effective corporate tax enforcement are critical levers for reducing structural inequality in labor markets. Moreover, fostering transparency through ESG mandates may amplify these effects by altering firm behavior in the absence of direct regulation.

The triangulation of econometric evidence with document-based qualitative analysis adds robustness to the findings by demonstrating that fiscal structures and fiscal discourses reinforce one another in shaping labor outcomes.

Finally, this research demonstrates the value of a mixed-methods, transdisciplinary approach to studying fiscal governance and labor inequality. By combining quantitative modeling with qualitative content analysis, the study captures both structural patterns and discursive frameworks, offering a more comprehensive understanding of how fiscal regimes shape the social organization of work. In doing so, it opens avenues for future research on the dynamic interactions between law, finance, corporate governance, and labor institutions in the context of global economic transformation.

6. CONCLUSION

This study contributes to the expanding literature at the intersection of fiscal governance, labor market inequality, and corporate financial behavior by providing a rigorous cross-national analysis of how taxation regimes shape distributive outcomes in advanced economies. Through an integrated mixed-methods design – combining fixed-effects panel regression with directed qualitative content analysis of policy and corporate documentation – it demonstrates that fiscal structures are not neutral backdrops to labor relations, but active institutional forces that condition organizational decisions and the material distribution of income.

The main conclusions rest directly on the empirical relationships identified in the econometric estimation and on the thematic evidence emerging from the 253 policy and corporate documents analyzed. This dual evidence base strengthens the validity of the argument that fiscal design and fiscal discourse jointly influence labor outcomes.

Empirically, the study identifies three key mechanisms through which fiscal regimes influence labor inequality: first, the progressivity of personal income taxation, which correlates with greater post-tax income compression; second, the magnitude of corporate tax collection relative to GDP, which serves both as a revenue source for redistribution and as a signal of regulatory robustness; and third, the degree of corporate tax and labor-related transparency, which appears to exert normative pressure on firms to moderate internal wage hierarchies and invest in stable employment models. These mechanisms, validated through both statistical modeling and discourse analysis, offer a robust explanatory framework linking macro-level fiscal architecture to meso-level corporate behavior and micro-level labor outcomes.

Theoretically, the findings reinforce the premise that fiscal policy is a foundational element of institutionalized labor market governance. They also extend the scope of comparative political economy by incorporating fiscal transparency – often treated as a technical or legalistic concern – as a socially consequential dimension in shaping employment systems. The inclusion of ESG tax disclosure practices as an explanatory variable opens new space for interdisciplinary inquiry at the confluence of public finance, corporate governance, and labor regulation.

From a policy perspective, the results affirm that redistributive taxation and fiscal enforcement remain viable and effective tools for reducing structural inequality, even in the context of globalization, technological disruption, and labor market flexibilization. Countries that maintain high top marginal income tax rates, effectively collect corporate taxes, and promote transparency tend to exhibit narrower wage gaps, stronger internal equity in firms, and lower levels of labor precarity. These findings challenge the often-invoked dichotomy between equity and competitiveness, and instead suggest that coherent, progressive fiscal institutions can support both.

Nevertheless, as requested by the reviewers, the limitations of the study merit emphasis: (i) while associations are strong, causal pathways cannot be fully established; (ii) country-level aggregates may overlook subnational variation; and (iii) the ESG transparency index, although constructed systematically, depends on publicly disclosed information that may vary in detail and sincerity across firms.

Future research could build on this work by employing firm-level panel data, exploring subnational fiscal regimes, or examining how global tax coordination initiatives, such as the OECD Pillar Two agreement – affect corporate wage structures and employment models.

In conclusion, this study underscores the enduring relevance of fiscal policy—not only as a macroeconomic instrument, but as a social institution embedded in broader regimes of labor governance, corporate accountability, and democratic legitimacy. As advanced economies confront rising inequality, ecological transition, and digital disruption, fiscal regimes will increasingly serve as contested arenas in which questions of justice, resilience, and economic purpose are negotiated. By articulating the connections between taxation, transparency, and labor outcomes, this research contributes a timely and policy-relevant perspective to ongoing debates about how to construct more equitable and sustainable economic orders.

REFERENCES

Appelbaum, E., Batt, R., & Clark, I. (2013). Financialization, shareholder value and the future of work. *Dialogues in Human Geography, 3*(1), 29–47. https://doi.org/10.1177/2043820613476177

Atkinson, A. B. (2015). *Inequality: What can be done?* Harvard University Press.

Bastani, S., & Waldenström, D. (2020). How should capital be taxed? *Journal of Economic Surveys, 34*(4), 812–846. https://doi.org/10.1111/joes.12334

Bastiaens, I., & Rudra, N. (2016). Trade liberalization and the challenges of revenue mobilization: Can globalization support the welfare state? *World Politics, 68*(3), 423–457. https://doi.org/10.1017/S0043887116000052

Bini, L., & Giunta, F. (2022). ESG disclosure and corporate social legitimacy: Evidence from European listed companies. *Journal of Business Ethics, 181*(2), 463–489. https://doi.org/10.1007/s10551-021-04900-8

Boer, D., Overesch, M., & Werthebach, A. (2025). *Inclusion of taxes in sustainability reports: Do firms provide relevant tax information?* SSRN. https:// papers.ssrn.com/sol3/ papers.cfm?abstract_ id=5183444

Bozio, A., Garbinti, B., Goupille-Lebret, J., Piketty, T., & Zucman, G. (2021). *Predistribution vs. redistribution: Evidence from France and the U.S.* World Inequality Lab Working Paper No. 2021/04.

Braun, B., & Gabor, D. (2020). Central banking, shadow banking, and infrastructural power. *Socio-Economic Review, 18*(3), 675–702. https://doi.org/10.1093/ser/mwz011

Busemeyer, M. R., & Garritzmann, J. L. (2017). Public opinion on policy and budgetary trade-offs in European welfare states. *Journal of European Public Policy, 24*(6), 871–889. https://doi.org/10.1080/13501763.2016.1170197

Cobham, A., & Janský, P. (2021). *Global distribution of revenue loss from tax avoidance*. International Tax and Public Finance, 28, 1271–1300. https://doi.org/10.1007/s10797-020-09630-w

De Mooij, R., & Hebous, S. (2020). *Curbing corporate debt bias: Do limitations to interest deductibility work?* IMF Economic Review, 68(1), 130–158. https://doi.org/10.1057/s41308-020-00109-6

De Stefano, V., & Aloisi, A. (2020). Fundamental labor rights, platform work and human-rights-based approaches to algorithmic management. *International Labour Review, 159*(4), 605–630. https://doi.org/10.1111/ilr.12226

European Union. (2021). *Directive (EU) 2021/2101 of the European Parliament and of the Council of 24 November 2021 amending Directive 2013/34/EU as regards disclosure of income tax information by certain undertakings and branches. Official Journal of the European Union.* https://eur-lex.europa.eu/eli/dir/2021/2101/oj

GRI. (2024). *Global adoption trends for the GRI Tax Standard (GRI 207).* Global Reporting Initiative. https://www.globalreporting.org/media/2tinc4tc/gri_207_adoption_study-1.pdf

Guschanski, A., & Onaran, Ö. (2021). The labor share and financialization: Evidence from publicly listed firms. *Cambridge Journal of Economics, 45*(3), 383–408. https://doi.org/10.1093/cje/beaa034

Hebous, S., & Mengistu, A. A. (2024). *Efficient economic rent taxation under a global minimum corporate tax.* International Monetary Fund. (IMF Working Paper).

https://www.oecd.org/content/dam/oecd/en/publications/reports/2024/01/the-global-minimum-tax-and-the-taxation-of-mne-profit_2c3d9f9d/9a815d6b-en.pdf

Hugger, F., González Cabral, A. C., Hanappi, T., Åkerblom, S., & Millot, V. (2024). *The global minimum tax and the taxation of MNE profit.* OECD Taxation Working Papers, No. 68. OECD Publishing.

https://www.oecd.org/content/dam/oecd/en/publications/reports/2024/01/the-global-minimum-tax-and-the-taxation-of-mne-profit_2c3d9f9d/9a815d6b-en.pdf

Krippner, G. R. (2005). The financialization of the American economy. *Socio-Economic Review, 3*(2), 173–208. https://doi.org/10.1093/SER/mwi008

Mayring, P. (2014). *Qualitative content analysis: Theoretical foundation, basic procedures and software solution*. Klagenfurt: Beltz.

OECD. (2022a). *Tax Policy Reforms 2022: OECD and Selected Partner Economies*. https://doi.org/10.1787/6e52ef57-en

OECD. (2022b). *Income inequality and poverty by country*. https://data.oecd.org/inequality/income-inequality.htm

OECD. (2024a). *Tax policy reforms 2024.* OECD Publishing.

https://www.oecd.org/en/publications/tax-policy-reforms-2024_c3686f5e-en.html

OECD. (2024b). *Country-by-country reporting: Compilation of 2024 peer review reports.* OECD Publishing. https://www.oecd.org/en/publications/2024/09/country-by-country-reporting-compilation-of-2024-peer-review-reports_2d920602.html

Schreier, M. (2012). *Qualitative content analysis in practice*. London: SAGE.

Stiglitz, J. E., Fitoussi, J.-P., & Durand, M. (2021). *Beyond GDP: Measuring what counts for economic and social performance*. OECD Publishing. https://doi.org/10.1787/9789264307292-en

Tørsløv, T. R., Wier, L. S., & Zucman, G. (2022). *The missing profits of nations*. *Review of Economic Studies, 89*(2), 913–944. https://doi.org/10.1093/restud/rdab036

Tuinsma, T., Van der Hel, L., De Wilde, M., & Van de Streek, J. (2023). *Effects of corporate transparency on tax avoidance: Evidence from the European public country-by-country reporting initiative* (Working Paper 2023-04). University of Amsterdam / Amsterdam Centre for Tax Law. https://www.econstor.eu/bitstream/10419/286333/1/wp-2023-04.pdf

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Altitude and Agroecological Conditions in Production, Profitability, and Risks of Alfalfa (*Medicago Sativa*) Cultivation in the Highlands of Lima, Peru

Altitude e Condições Agroecológicas na Produção, Rentabilidade e Riscos do Cultivo de Alfafa (*Medicago Sativa*) nas Terras Altas de Lima, Peru

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Abstract

Alfalfa (*Medicago sativa*) is a crucial legume as fodder for livestock, especially in high Andean regions. Despite its growing national importance, production remains limited by agroecological and climatic factors, mainly altitude. In this context, this study estimated the profitability and risks of alfalfa production in the district of San Andrés de Tupicocha, located in the highlands of Lima, Peru. To this end, surveys were conducted with producers during the year 2024, collecting information on yields, costs and risk perceptions. Profitability was analyzed using a stochastic Monte Carlo simulation of the Net Present Value (NPV), complemented by statistical tests comparing two zones with different altitudes and agroecological conditions. On average, the NPV/ha was S/ 159,555; with S/ 134,832 in the high zone (up to 4000 m.a.s.l) and S/ 188,286 in the low zone (up to 2500 m.a.s.l). The high zone showed a higher probability of economic losses, mainly due to frost and heavy rains. These findings suggest that, in order to improve productive efficiency and mitigate risks, it is necessary to implement strategies differentiated according to altitude and local agroecological characteristics. This differentiation will allow optimizing land use and available resources, favoring the sustainability of alfalfa production in the district.

Keywords: Alfalfa; profitability of permanent crop; risks in agriculture, stochastic simulation, agroecological conditions

JEL Codes: Q12, Q16, C63

Resumo

A alfafa (*Medicago sativa*) é uma leguminosa crucial como forragem para o gado, especialmente nas regiões andinas altas. Apesar da sua crescente importância nacional, a produção continua limitada por fatores agroecológicos e climáticos, principalmente a altitude. Neste contexto, este estudo estimou a rentabilidade e os riscos da produção de alfafa no distrito de San Andrés de Tupicocha, localizado nas terras altas de Lima, Peru. Para tal, foram realizadas pesquisas com produtores durante o ano de 2024, recolhendo informações sobre rendimentos, custos e perceções de risco. A rentabilidade foi analisada utilizando uma simulação estocástica de Monte Carlo do Valor Presente Líquido (VPL), complementada por testes estatísticos comparando duas zonas com diferentes altitudes e condições agroecológicas. Em média, o VPL/ha foi de S/ 159.555; com S/ 134.832 na zona alta (até 4000 m.a.s.l) e S/ 188.286 na zona baixa (até 2500 m.a.s.l). A zona alta apresentou maior probabilidade de perdas económicas, principalmente devido à geada e às chuvas fortes. Esses resultados sugerem que, para melhorar a eficiência produtiva e mitigar os riscos, é necessário implementar estratégias diferenciadas de acordo com a altitude e as características agroecológicas locais. Essa diferenciação permitirá otimizar o uso da terra e dos recursos disponíveis, favorecendo a sustentabilidade da produção de alfafa no distrito.

Palavras-chave: Alfalfa; rentabilidade das culturas permanentes; riscos na agricultura, simulação estocástica, condições agroecológicas.

Classificação JEL: Q12, Q16, C63

1. INTRODUCTION

Alfalfa (*Medicago sativa*), known as the “King of Forages” (Feng et al., 2022), is one of the most widely cultivated and important legume species in Peru due to its use as feed for both large and small livestock (especially guinea pigs and rabbits). For this reason, the Peruvian Ministry of Agrarian Development and Irrigation [MIDAGRI] (2025) states that this crop is becoming a key component of the national agricultural sector.

According to the Peruvian Ministry of the Environment [MINAM] (2019), alfalfa cultivation is considered a cultivated pasture agroecosystem, where agricultural fields function as artificial systems composed of interacting inputs that generate outputs. The productivity and quality of the crop depend on the efficiency of these processes, which in turn determine the crop’s profitability and sustainability.

In 2024, national alfalfa production reached 7.766,425 metric tons, with the majority concentrated in the regions of Arequipa (34%) and Puno (25%) (MIDAGRI, 2025). According to the Peruvian Integrated System of Agricultural Statistics [SIEA] (2025), alfalfa accounts for 17.3% of the cultivated area in the Lima region. Specifically, in the district of San Andrés de Tupicocha, as of 2024, there are 99.60 hectares of alfalfa under cultivation, representing approximately 15% of the district’s total area.

On the demand side, the dynamism of the crop is reflected in the increase in the Gross Value of Agricultural Production (GVAP), which grew by 14.6% between January 2023 and May 2024 (MIDAGRI, 2024). The main production areas in Peru are concentrated in the Andean region, with Puno leading national production (46.7%), followed by Arequipa (22.65%) (MIDAGRI, 2024).

In Latin America, countries such as Argentina—in the Pampa Ondulada region—and Brazil—in the states of Paraná and Rio Grande do Sul—stand out for their alfalfa production, which ranges between 14 and 22 tons per hectare. In these countries, alfalfa is primarily used as forage for feeding large livestock, significantly contributing to the production and quality of beef and dairy products (Blain et al., 2023; Dos Santos et al., 2020). This positions alfalfa as a strategic resource for animal nutrition. Similarly, in the Peruvian context, alfalfa production is considered a strength for agrarian development (Bazán et al., 2017).

On the other hand, it is important to highlight that water availability is a key factor in alfalfa cultivation. However, in many production areas of Peru, it is grown under rainfed conditions, which limits its economic potential (MINAM, 2019). In Chile, Inostroza (2022) notes that alfalfa production is highly profitable even under rainfed conditions; nevertheless, he reports that the productivity of rainfed alfalfa fields can be half that of irrigated ones. In this study, it is important to mention that 100% of the respondents reported having access to water sources from the district's reservoirs (Durand, 2011).

In the province of Huarochirí, alfalfa plays a crucial role in the local economy. In 2019, it was the second-highest income-generating agricultural product in the province, accounting for 18.53% of the Gross Value of Agricultural Production (GVAP). It also occupied the largest harvested area between 2015 and 2019, reaching 1,759 hectares in 2019, equivalent to 25.66% of the total harvested area in the province (INEI & MIDAGRI, 2023).

Specifically, in the district of San Andrés de Tupicocha, alfalfa accounts for 63% of the district's GVAP (SIEA, 2025). Despite its economic relevance, there is a lack of detailed economic studies on alfalfa cultivation in Peru, particularly in highland areas such as Huarochirí.

Given this context, the aim of this paper was to estimate the profitability and risks associated with alfalfa production in the district of San Andrés de Tupicocha, Huarochirí, Lima, Peru, considering two different agroecological zones based on the altitude at which this economic activity is carried out.

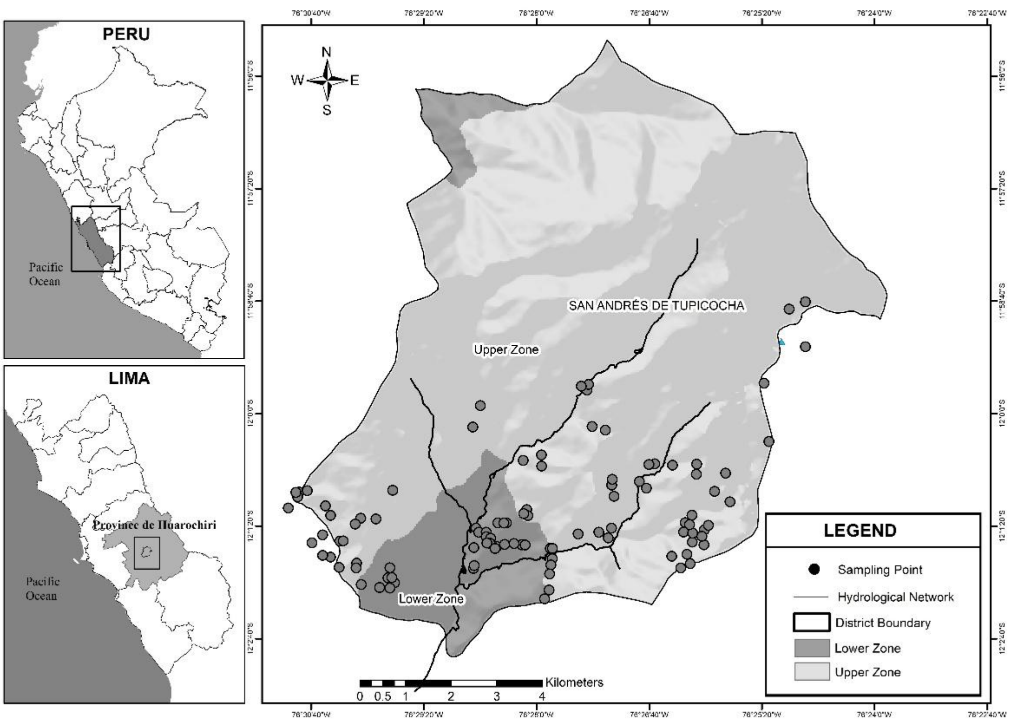
2. MATERIALS AND METHODS

2.1 Area of study

San Andrés de Tupicocha is a district located in the province of Huarochirí, in the department of Lima, Peru. It has an average elevation of 3,606 meters above sea level and is situated at 12° 00' 07" south latitude and 76° 28' 29" west longitude. The district covers an area of 83.35 km² and has access to various ecological zones, which allows for a diversity of agricultural products (Gómez de la Torre Barrúa & Ibañez Blancas, 2023; Cantaro-Segura et al., 2021).

It is worth noting that communal dam systems were constructed in this district in the early 2000s (Durand, 2011), which significantly improved access to water resources, particularly for agricultural use. This advancement enabled year-round farming and triggered a boom in alfalfa cultivation beginning in 2010. Based on fieldwork conducted in the district, two distinct production zones for alfalfa can be identified: a high-altitude zone (up to 4,000 meters above sea level) and a low-altitude zone (up to 2,500 meters above sea level).

Figure 1: Location map of the district of San Andrés de Tupicocha, Lima, Peru



2.2 Research design

This study adopted a sequential methodological approach aimed at estimating both the profitability and economic risk associated with alfalfa cultivation in the district of *San Andrés de Tupicocha*, located in the highlands of Lima, Peru. This design made it possible to account for the agroecological diversity of the territory—particularly the differences between zones at varying altitudes—and how these influence farmers' economic outcomes.

The procedure was structured into four stages. First, the Net Present Value (NPV) of profitability was estimated for each farmer based on detailed field data, including initial investment, per-harvest costs, production horizon, and selling prices. This information was standardized per hectare. The estimation provided a baseline of the crop's economic performance under observed conditions.

In the second stage, the variability of key economic variables was incorporated through the application of Stochastic Monte Carlo Simulation (SMC) using @Risk software. This technique allowed for the simulation of multiple possible scenarios in which prices and investment fluctuated according to probability distributions fitted to empirical data. As a result, a probabilistic range of NPV values was constructed for each farmer, capturing the inherent uncertainty of agricultural production.

In the third stage, a profitability comparison was made between the high-altitude and low-altitude zones of the district using a two-sample t-test. This statistical test was used to determine whether the observed differences in average NPVs between the two zones were statistically significant—thus justifying a differentiated economic analysis.

Finally, in the fourth stage, the Monte Carlo simulations were repeated separately for each production zone. This disaggregation not only allowed for the estimation of expected NPV values by altitude but also made it possible to analyze the dispersion and variation ranges associated with each productive area.

2.3 Indicators of economic profitability of permanent crops

Cost-benefit analysis is a theoretically robust and widely applied tool for evaluating the economic viability of investment decisions (Das et al., 2024; Roberts et al., 2023). Within this framework, the discounted cash flow method is used to calculate the NPV of cash flows generated by an investment. This is particularly relevant when there is a time lag before all benefits are realized (Kabir et al., 2025).

According to Kabir et al. (2025), Maaß and H. Kehlenbeck (2024), and Jin et al. (2023), the NPV is estimated using the following expression:

$$NPV = \sum_{t=1}^{N} \frac{B_t - C_t}{(1+r)^t} \dots (1)$$

Where: B_t: benefits at time t; C_t: costs at time t; r: discount rate; N: number of periods

In addition, the Internal Rate of Return (IRR) is used to evaluate an investment decision by comparing it with the best available alternatives at a given bank interest rate. An IRR higher than other available rates of return (e.g., the bank rate), or an IRR that makes the NPV equal to zero, indicates that the investment is economically viable (Sokolov, 2024; Ben-Horin, 2017).

It is worth noting that NPV and IRR are widely used decision-support criteria that help identify the most economically viable investment options among alternatives (Chizmar et al., 2020). However, IRR does not capture the risks or uncertainty inherent in most agricultural investment projects (Vilani et al., 2024). Therefore, in this study, the economic evaluation of alfalfa cultivation investment decisions will be carried out using the NPV as the primary decision criterion.

2.4 Stochastic Monte Carlo simulation (SMC)

SMC is a quantitative technique that allows modeling economic phenomena under conditions of uncertainty by generating multiple possible scenarios for the variables that influence a project's performance (Maggauer & Fina, 2025; McNulty et al., 2021; Rahaman & Abdul, 2025). This technique uses probability distributions to represent the expected behavior of key variables such as prices, yields, or costs, enabling the estimation not only of average values but also of variation ranges and the probability of occurrence of different economic outcomes (Pawlak, 2024; Celestin et al., 2025).

According to Traverso et al. (2021), its application enhances the accuracy of risk profiling by explicitly incorporating uncertainty into economic evaluations. In agricultural activities, this technique has been used to capture the inherent variability of production systems exposed to climatic risks, price fluctuations, and changes in productivity (Amorim et al., 2024; Liu et al., 2017). Through SMC, these sources of uncertainty can be modeled in a structured way, allowing for the anticipation of economically adverse scenarios and more informed decision-making regarding resource allocation and production planning (Oktoviany et al., 2021; Mahmudiono et al., 2022; Javadi et al., 2024).

When applied to permanent crops, SMC makes it possible to account for cumulative risks associated with long production horizons. These include soil degradation, interannual variability in productivity, and the persistent effects of climate on crop yields (Cesca et al., 2024). In such contexts, the technique enables not only the estimation of the expected NPV but also the analysis of outcome dispersion, the identification of the probability of economically unfavorable scenarios, and the evaluation of the stability of net cash flows throughout the production cycle (Kunwar et al., 2025; Trejo-Pech et al., 2024).

This ability to estimate both economic returns and exposure to risk provides a more precise analysis of long-cycle crops such as alfalfa, whose economic performance depends on variable agroecological conditions and technical decisions that influence outcomes over the entire productive horizon.

Thus, the average result from the Monte Carlo Simulation for each variable was obtained using the following equation:

$$a_m = \frac{1}{n}\sum_{i=1}^{n} x_i \dots (2)$$

where a_m is the mean result of the Monte Carlo Simulation (MCS) for the variable, x represents the individual outcome of each simulated iteration, and n is the total number of simulations. The value a_m acts as the normalization factor, indicating that the sum of all simulated results is divided by the number of iterations. The expression $1/n$ is used to estimate the expected value or average outcome across the simulations. It represents the central tendency of a variable or the average result of multiple simulated outcomes. By dividing the sum of simulated outcomes by the total number of simulations (or by the normalization factor), the model yields an estimation of the expected value of the system or process being analyzed.

3. RESULTS AND DISCUSSION

3.1 Descriptive results

Table 1. Main descriptive statistics of alfalfa production dynamics

Indicator	Mean	Std. Dev.	Min	Max	Mode
Farmer's gender (0 = male, 1 = female)	0.16*	0.37	0	1	0
Farmer's age (years)	48.2	13.64	23	79	54
Education level (0 = no education, 1 = incomplete primary, 2 = completed primary, …, 12 = completed PhD)	3.73	1.008	2	8	4
Years of experience as a farmer	22.9	12.36	3	60	30
Years of experience in alfalfa production	11.22	6.51	2	30	10
Total cultivated area (ha)	1.73	0.67	0.5	4	2
Area dedicated to alfalfa (ha)	0.33	0.28	0.063	1	0.25
Exclusive alfalfa producrion for sale (0 = yes, 1 = no)	0.22**	0.41	0	1	0
Source of information for agricultural decision-making (0 = MIDAGRI/other institutions, 1 = internet and social media, 2 = seed store, 3 = fellow farmers, 4 = other sources	3.02	0.55	0	4	3
Alfalfa production throughout the year (0 = no, 1= yes)	0.43***	0.5	0	1	0
Main reason for year-round production (0 = contractual agreement with buyer, 1 = feed for livestock and/or small animals, 2 = other reason)	0.17****	0.59	0	2	0
Alfalfa sale (0 = local market, 1 = intermediary, 2 = both)	1	0	1	1	1

** The percentage of male farmers is 83.7%*

*** The percentage of farmers who produce alfalfa exclusively for sale is 78.8%*

**** The percentage of farmers who produce alfalfa year-round is 56.3%*

***** The percentage of farmers who report having a contractual agreement with a buyer is 86.3%*

As shown in Table 1, most alfalfa producers in *San Andrés de Tupicocha* are male, with an average (and modal) age close to 50 years. Regarding educational attainment, 33% of respondents reported having completed secondary education, and some farmers indicated having completed higher education, including university degrees.

The producers in the district reported an average of 23 years of farming experience, with a maximum of 60 years and a mode of 30 years. Specifically for alfalfa cultivation, the average experience was approximately 10 years, which also matches the modal value. This pattern reflects the boom in alfalfa production in the district following the implementation of water harvesting and irrigation infrastructure projects (Durand, 2011), given that alfalfa is a crop with significant water requirements (Crookston et al., 2025).

In terms of the categorization of the farming system, both overall and specifically for alfalfa cultivation, producers are best classified as smallholders. This is evident from the limited scale of operations, with total agricultural landholdings not exceeding 4 hectares and the maximum area allocated to alfalfa reaching only 1 hectare. Notably, 78.8% of producers reported cultivating alfalfa exclusively for sale, while a smaller proportion also uses it for dual purposes—primarily as forage for small animals such as guinea pigs and rabbits. Moreover, 56.3% of farmers indicated that they produce alfalfa throughout the entire year, including the most agronomically challenging months (June, July, and August), which are typically marked by adverse climatic conditions.

Another relevant finding is that most farmers rely on peers or seed suppliers (mainly based in Lima) as their primary sources of information for production-related decisions, such as seed quality or price volatility of inputs. Additionally, 86.3% reported having a standing agreement or contract with a buyer, which aligns with the fact that 100% of farmers sell their production through intermediaries.

Survey data also revealed the diversity of crops cultivated in both ecological zones. In the high-altitude zone, the main commercial crops reported were alfalfa, peas, fava beans, and potatoes, with a combined average of 73% of responses. Other crops with lower incidence included barley and aromatic herbs such as lemon verbena, rosemary, rue, and oregano. In contrast, the main crops reported in the lower-altitude zone were alfalfa, plums, fava beans, potatoes, avocados, and aromatic herbs, accounting for an average of 68% of responses. Other less commonly cultivated products in this zone included peas, apples, cherimoya, and prickly pear.

3.2 Results of the economic evaluation

This section aims to assess the economic profitability of alfalfa cultivation, considered a permanent crop within a medium-term rotation horizon ranging from 24 to 48 months. To this end, the Net Present Value (NPV) was estimated as the discounted net benefit, treating the cultivation as an agricultural investment project. Discounting future cash flows eliminates temporal differences, expressing all economic values in terms of the base or investment year (Majerova et al., 2022).

Since each producer displays particular characteristics in terms of investment schemes, harvest schedules, and cutting frequencies—as reported in the surveys—the NPV analysis was conducted individually, using the specific information provided by each farmer. The main descriptive indicators related to the crop are presented in Table 2.

The initial investment includes costs associated with various agricultural tasks and inputs: fumigation, fertilization, labor, seed acquisition, machinery use, irrigation tapes, and other complementary irrigation accessories. The benefits are derived from the income generated through the sale of alfalfa during the harvest period. Additionally, recurrent costs per harvest include labor payments and irrigation materials such as tapes and water.

Table 2: Economic Evaluation Results of Alfalfa Cultivation

Indicator	Mean	Min	Max	Mode
Crop duration (months)	33	24	48	36
Months until first harvest	6	5	8	2
Harvest frequency (months)	2	1	2	2
Total investment (PEN)	26,562	10,800	42,080	27,920
Cost per harvest (PEN)	3,286	1,900	4,1450	3,400
Quantity harvested per event (kg)	770	400	1,000	800
Net Present Value (NPV) (PEN)	**159,555**	**82,669**	**310,124**	**143,433**

The results show that alfalfa cultivation yields an average NPV per hectare of PEN 159,555 per farmer, indicating substantial economic profitability under average investment and production conditions. However, it is important to note that in the study district, the average area allocated to alfalfa cultivation is only 0.33 hectares.

3.2.1 Results of the probabilistic analysis

To capture the inherent uncertainty in agricultural activity, a MCS analysis was conducted on the Net Present Value (NPV) of alfalfa production. This procedure incorporated seasonal variability in market prices and the observed dispersion in both initial and recurrent investment costs, based on data collected during fieldwork.

Regarding prices, three distinct market seasons were identified:

- *High season (3 months):* Average price PEN 29.26/kg.
- *Mid season (4 months):* Average price PEN 16.49/kg.
- *Low season (remaining 5 months):* Average price PEN 10.98/kg.

Empirical distribution functions were also incorporated for the main cost components, including seed acquisition, irrigation systems, and labor. The simulation was performed using the @Risk software, running 10,000 iterations per farmer, thereby generating a robust range of potential scenarios for individual NPVs.

The total expected NPV, considering all producers in the sample and simulated scenarios, was estimated at PEN 159,592 per farmer (Table 3). This figure aligns closely with the deterministic average NPV (PEN 159,555), suggesting considerable stability in economic returns under uncertain conditions. The 95% confidence interval for the NPV ranged from PEN 133,460 to PEN 182,201, indicating moderate dispersion in the results.

Table 3: Probabilistic Evaluation Results of alfalfa cultivation

Indicator	Expected	Min Expected	Max Expected	Mode	Std. Dev.
Total Average NPV (PEN)	159,592	133,460	182,201	160,208.37	7,361.32

It is worth noting that in 100% of the simulated iterations, the project remained profitable—that is, a positive NPV was achieved. This indicates that even under adverse price or cost scenarios, alfalfa cultivation remains an economically viable option within the local context.

These findings reinforce the case for sustained investment in forage crops such as alfalfa, especially in Andean territories with access to irrigation systems and relatively stable climatic conditions. Furthermore, the consistency between the simulated and deterministic NPV suggests that the crop exhibits a low-risk structure in the face of moderate economic shocks—an important strategic advantage for small-scale farmers with risk-averse profiles.

3.2.2 Profitability comparison across agroecological zones

In addition, considering the agroecological heterogeneity of the study area, the sample was classified into two zones based on altitude: high zone (up to 4,000 meters above sea level) and low zone (up to 2,500 meters above sea level). To determine whether there were statistically significant differences in profitability between the two zones, a student's t-test for the difference in means was applied to individual NPV values. The results are presented in Table 4:

Table 4: Results of the mean difference test

Group		Obs	Mean	Std.Error	p-value
Total Average NPV		80	159,555	5,516	0.000***
	Low zone	37	188,286	7,439	
	High zone	43	134,832	5,848	

*Note: *** p<0.01, statistically significant at 1%*

The analysis revealed a highly significant difference between the two zones ($p < 0.01$), which justified the implementation of a disaggregated probabilistic analysis. Based on this, expected NPV values and variability ranges were estimated for each zone, again applying the MCS technique with functions adjusted to the specific conditions of each production zone (Table 5).

Table 5. Expected NPV by agroecological zone

Indicator	Expected Mean	Min Expected	Max Expected
NPV – Low Zone	188,332	156,973	215,454
NPV – High Zone	134,864	113,229	153,589

The results confirm that alfalfa cultivation is profitable in both zones under conditions of uncertainty, though with a substantial difference in the magnitude of net benefits. The low zone shows an expected NPV that is 39.6% higher than that of the high zone. This differential is primarily attributed to a higher harvest frequency and lower exposure to extreme climatic events, such as frosts.

Furthermore, although the NPV range in the low zone is wider, it consistently remains within high-profitability levels across all simulated scenarios. This indicates greater tolerance to market fluctuations without compromising economic viability. In contrast, the high zone exhibits tighter profit margins and a shorter productive horizon, which increases the crop's sensitivity to changes in input costs or market prices.

3.3 Discussion

The economic assessment of alfalfa cultivation in the district of *San Andrés de Tupicocha* reveals sustained and consistent profitability, even under conditions of uncertainty. The average Net Present Value (NPV) obtained (PEN 159,555) and its expected value under MCS (PEN 159,592) exhibit minimal dispersion, suggesting a low exposure to economic risk. This degree of stability is particularly relevant in the context of high-Andean smallholder agriculture, which is typically characterized by climatic variability and technological constraints.

Although alfalfa is the district's primary forage crop, farmers in the high-altitude zone also grow peas, fava beans, and potatoes, while those in the low zone diversify into fruit crops such as plum and avocado, as well as aromatic herbs like rosemary, rue, lemon verbena, and oregano. This diversity reflects strategic resource allocation decisions shaped by agroecological conditions. In this context, alfalfa stands out for its consistent income stream, short cutting intervals, and linkage to relatively stable markets—evidenced by the high proportion of producers who market their harvests through pre-established contracts or agreements.

International literature reports average alfalfa yields ranging from 400 to 630 bales per hectare per season under rainfed conditions (INIA, 2024). In Tupicocha, reported yields are comparable in competitiveness, largely due to access to water from communal reservoirs and the use of gravity-based irrigation systems. However, cutting frequency and crop persistence have declined in recent years, with productive cycles decreasing from up to 10 years—according to local accounts—to only 2 to 4 years. This contraction is associated with the genetic degradation of seed vigor and the progressive erosion of soil fertility (MINAM, 2019).

The comparison between agroecological zones within the district revealed statistically significant differences in profitability. The low-altitude zone reported an average NPV of PEN 188,286, compared to PEN 134,832 in the high zone—a highly significant difference ($p < 0.01$). This gap stems from structural factors such as higher annual cutting frequency, more fertile soils, and reduced exposure to climatic extremes such as frost. These findings are consistent with studies such as Yao et al. (2022), which link altitude to reduced winter resilience and lower root productivity.

Methodologically, the incorporation of SMCS enhanced the economic analysis by capturing not only expected returns but also the range and probability of potential outcomes. In agricultural settings, where prices, yields, and costs fluctuate seasonally, this probabilistic approach represents a significant improvement over traditional deterministic evaluation (Traverso et al., 2021; Pawlak, 2024). In the present study, profitability was positive in 100% of the simulated scenarios, evidencing the technical and economic viability of the crop.

Furthermore, the benefit–cost ratio (B/C) – widely used in agricultural project appraisal (Frej et al., 2021) – constitutes a complementary metric for the economic evaluation of perennial crops. Although not estimated directly in this study, its relevance is supported by prior research on crops such as cacao, coffee, and tara in Peruvian contexts (Sarmiento, 2023; Hidalgo-Gonzales, 2021; Bashi-Pizarro, 2021; Gómez et al., 2022). In Mexico, Ríos-Flores et al. (2008) report that the B/C ratio for alfalfa increased from 1.53 to 1.69 between 1990 and 2005.

From a systemic perspective, agroecological conditions function as economic determinants. Although alfalfa is highly adaptable, it responds differently to variations in altitude, soil pH, and water availability. Dogbatse et al. (2020) found that productivity improves in alkaline soils and declines in acidic conditions, while Bover-Felices and Suárez-Hernández (2023) emphasize the importance of understanding agroecosystems as integrated units that shape both sustainability and economic efficiency.

In *San Andrés de Tupicocha*, these conditions delineate two contrasting agroecosystems: the low zone, characterized by greater thermal stability, fertility, and crop longevity; and the high zone, marked by harsher climatic exposure and lower yields. These differences impact not only profitability but also decisions around crop management, investment, and production planning. Although agronomic studies have examined alfalfa cultivation practices (Quispe-Guevara, 2022; Acharya et al., 2020), comparative profitability analyses by altitude remain scarce, despite their relevance for agricultural policy formulation.

In sum, the findings presented here demonstrate that alfalfa retains a comparative economic advantage over alternative productive options in the area. Its stable profitability, low risk profile, and technical adaptability position it as a strategic crop for high-Andean zones with functional irrigation infrastructure. The design of public interventions or technical assistance programs should account for intra-territorial differences, promoting tailored strategies based on agroecosystem characteristics, with an emphasis on improving agronomic sustainability and preserving the crop's remaining economic advantages.

4. CONCLUSIONS

This study estimated the economic profitability of a permanent crop of growing importance in Peru. It also demonstrated that the Net Present Value (NPV) per hectare in alfalfa production differs statistically between the high- and low-altitude zones within the study district. The economic performance of producers in the lowland zone is superior, despite exhibiting lower yields and higher production costs. This is primarily due to shorter production cycles—an average of 38 days in the lowland zone compared to 58 days in the highland zone.

These outcomes are closely associated with the agroecological conditions inherent to elevation, which give rise to distinct types of production risks depending on the zone. Thus, despite certain limitations of the study, the findings suggest that the design and implementation of agricultural technical assistance programs should adopt a differentiated approach—even when dealing with a single crop produced within the same district.

Finally, it is recommended that future policies on agricultural extension, technical assistance, and rural finance explicitly account for intra-district agroecological heterogeneity. Tailoring strategies by zone could enhance the technical and economic sustainability of alfalfa cultivation, contributing to more efficient resource management and improved resilience among smallholder farmers.

REFERENCES

Acharya, J. P., Lopez, Y., Gouveia, B. T., de Bem Oliveira, I., Resende Jr, M. F., Muñoz, P. R., & Rios, E. F. (2020). Breeding alfalfa (Medicago sativa L.) adapted to subtropical agroecosystems. *Agronomy, 10*(5), 742. https://doi.org/10.3390/agronomy10050742

Amorim, F. R. D., Guimarães, C. C., Afonso, P., & Tobias, M. S. G. (2024). Forecasting Cost Risks of Corn and Soybean Crops through Monte Carlo Simulation. *Applied Sciences, 14*(17), 8030. https://doi.org/10.3390/app14178030

Bashi-Pizarro, M. S. (2021). Caracterización tecnico-económica de sistemas agroforestales de café (Coffea arabica L.) en fundos cafetaleros de dos microcuencas de Pichanaki, Junín-Perú. Tesis pregrado

Bazán, R. V.; Yamada, A. G.; Coronado, S. L.; & Fuentes, N. N. (2017). Comportamiento Productivo de la Alfalfa (Medicago sativa) de la Variedad Caravelí Sometida al Pastoreo en el Valle de Huaral. *Revista de investigaciones veterinarias del Peru, 28*(3), 743. https://doi.org/10.15381/rivep.v28i3.13359

Ben-Horin, M., & Kroll, Y. (2017). A simple intuitive NPV IRR consistent ranking. The Quarterly *Review of Economics and Finance, 66*, 108–114. https://doi.org/10.1016/j.qref.2017.01.004

Blain, G., Assuero, S. G., & Berone, G. D. (2023). Altura de corte en alfalfa: producción y calidad nutritiva del forraje= Cutting height in alfalfa: production and nutritional quality of forage. *Revista de Investigaciones Agropecuárias*. https://doi.org/10.58149/s1hb-hw75

Bover-Felices, K., & Suárez-Hernández, J. (2023). Contribución del enfoque de la agroecología en el funcionamiento y estructura de los agroecosistemas integrados. Estación Experimental de Pastos y Forrajes Indio Hatuey, Universidad de Matanzas, Ministerio de Educación Superior.

Cantaro-Segura, J. L., Delgado-Palma, D., & Cayetano-Robles, J. L. (2021). Caracterización de la crianza de cuyes en una zona de la sierra de Huarochirí-Perú. *Revista de Investigación e Innovación Agropecuaria y de Recursos Naturales, 8*(2), 72-78. https://doi.org/10.53287/hffs7980xc24q

Celestin, M., Vasuki, M., Boakye, M. M., & Kumar, A. D. (2025). Monte Carlo simulations for assessing the impact of market uncertainty on investment portfolios. *International Journal of Scientific Research and Modern Education (IJSRME)*, *11*(2), 19-29. https://doi.org/10.5281/zenodo.14904146

Cesca, I. G., Postali, F. A. S., & Parente, V. (2024). Economic flexibilities and opportunities for sugar cane plants: A real options valuation case. *Cleaner and Circular* Bioeconomy, *7*, 100074. https://doi.org/10.1016/j.clcb.2024.100074

Chizmar, S., Castillo, M., Pizarro, D., Vasquez, H., Bernal, W., Rivera, R., ... & Cubbage, F. (2020). A discounted cash flow and capital budgeting analysis of silvopastoral systems in the Amazonas region of Peru. *Land, 9*(10), 353. https://doi.org/10.3390/land9100353

Crookston, B., Boren, D., Yost, M., Sullivan, T., Creech, E., Barker, B. & Reid, C. (2025). Irrigation technology, irrigation dose, and crop genetic impacts on alfalfa yield and quality. *Agricultural Water Management*. *311*(1), 109366. https://doi.org/10.1016/j.agwat.2025.109366

Das, T. K., Behera, B., Nath, C. P., Ghosh, S., Sen, S., Raj, R., ... & Paramanik, B. (2024). Herbicides use in crop production: An analysis of cost-benefit, non-target toxicities and environmental risks. *Crop protection, 181*, 106691. https://doi.org/10.1016/j.cropro.2024.106691

Dogbatse, J. A., Arthur, A., Padi, F. K., Konlan, S., Quaye, A. K., Owusu-Ansah, F., et al. (2020). Influence of acidic soils on growth and nutrient uptake of cocoa (Theobroma cacao L.) varieties. Commun. Soil Sci. *Plant Anal. 51*, 2280–2296. https://doi.org/10.1080/00103624.2020.1822384

dos Santos, I.G., Rocha, J.d., Vigna, B.B. (2020). Exploring the diversity of alfalfa within Brazil for tropical production. *Euphytica*, 216, 72 https://doi.org/10.1007/s10681-020-02606-w

Durand, P. (2011). Sembrando y cosechando agua. Proceso de adopción tecnológica y gestión del agua en la comunidad campesina de Cullpe: Una experiencia de autogestión campesina y cambio social. *Revista Andina, 51*(1): 9-41.

Feng, Y., Shi, Y., Zhao, M., Shen, H., Xu, L., Luo, Y., et al. (2022). Yield and quality properties of alfalfa (Medicago sativa L.) and their influencing factors in China. Eur. J. Agron. 141, 126637 https://doi.org/10.1016/j.eja.2022.126637

Frej, E. A., Ekel, P., & de Almeida, A. T. (2021). A benefit-to-cost ratio-based approach for portfolio selection under multiple criteria with incomplete preference information. *Information Sciences, 545*, 487-498. https://doi.org/10.1016/j.ins.2020.08.119

Gómez de la Torre Barrúa, J.; & Ibañez Blancas, A. N. (2023). Encuentros y desencuentros percibidos entre comuneros y docentes en torno a la innovación en las amunas de San Andrés de Tupicocha, Huarochirí, Perú. Collectivus. *Revista de Ciencias Sociales, 10*(1), 81- 110. https://doi.org/10.15648/Collectivus.vol10num1.2023.3566

Gómez, R., Diez, R., Vasquez, C. & Vargas, J. (2022) Rentabilidad del cultivo de tara Caesalpinia spinosa (Molina) Kuntze en Apurímac, Perú. *Anales Científicos. 83*(2), 175-184. https://doi.org/10.21704/ac.v83i2.1960

Hidalgo-Gonzales, C. D. R. (2021). Análisis comparativo de la rentabilidad económica de sistemas agroforestales y cultivos tradicionales de dos comunidades nativas, en el distrito de Irazola, Ucayali. Tesis pregrado

Instituto Nacional de Estadística e Informática [INEI] & Ministerio de Desarrollo Agrario y Riego [MIDAGRI]. (2023). *Encuesta Nacional Agropecuaria 2022*. Instituto Nacional de Estadística e Informática. https://www.inei.gob.pe

INIA. (2024). INIA lanza primera variedad de alfalfa de secano que destaca por su alta persistencia y potencial productivo | INIA. https://www.inia.cl/2024/07/08/inia-lanza-primera-variedad-de-alfalfa-de-secano-que-destaca-por-su-alta-persistencia-y-potencial-productivo/

Inostroza, F. (2022). Alfalfa, una alternativa de alta rentabilidad para los productores de la precordillera de Ñuble. *Praderas*. *RedAgrícola*. https://hdl.handle.net/20.500.14001/68783

Javadi, A., Ghahremanzadeh, M., Sassi, M., Javanbakht, O., & Hayati, B. (2024). Impact of climate variables change on the yield of wheat and rice crops in Iran (application of stochastic model based on Monte Carlo simulation). *Computational Economics, 63*(3), 983-1000. https://doi.org/10.1007/s10614-023-10389-0

Jin, Y., Lee, S., Kang, T., Park, J., & Kim, Y. (2023). Capacity Optimization of Rainwater Harvesting Systems Based on a Cost–Benefit Analysis: A Financial Support Program Review and Parametric Sensitivity Analysis. *Water, 15*(1), 186. https://doi.org/10.3390/w15010186

Kabir, M. J., Gaydon, D. S., & Cramb, R. (2025). Evaluation of crop and pond deepening adaptations to climate change in saline coastal Bangladesh: Benefit cost and risk analysis. *Agricultural Water Management, 308*, Article 109274. https://doi.org/10.1016/j.agwat.2024.109274

Kunwar, S. R., Fonsah, E. G., & Escalante, C. L. (2025). An Assessment of Profitability Using Monte Carlo Simulation Approach: A Case of Georgia Blueberry Industry. *Journal of Food Distribution Research, 56*(1).

Liu, J., Li, Y. P., Huang, G. H., Zhuang, X. W., & Fu, H. Y. (2017). Assessment of uncertainty effects on crop planning and irrigation water supply using a Monte Carlo simulation based dual-interval stochastic programming method. *Journal of Cleaner Production, 149*, 945-967. https://doi.org/10.1016/j.jclepro.2017.02.100

Maaß, O., & Kehlenbeck, H. (2024). Cost–Benefit Analysis of Monitoring Insect Pests and Aerial Spraying of Insecticides: The Case of Protecting Pine Forests against Dendrolimus pini in Brandenburg (Germany). *Forests, 15*(1), 104. https://doi.org/10.3390/f15010104

Maggauer, K., & Fina, B. (2025). Monte Carlo simulation-based economic risk assessment in energy communities. *Energy Reports, 13*, 987-1003. https://doi.org/10.1016/j.egyr.2024.12.046

Mahmudiono, T., Yasin, G., Jasim, S. A., Alghazali, T. A. H., Kadhim, M. M., Iswanto, A. H., ... & Panduro-Tenazoa, N. M. (2022). Analyzing food production risk with Monte Carlo simulation. *Food Science and Technology, 42*, e03522. https://doi.org/10.1590/fst.03522

Majerova, I., Michna, P., Lebiedzik, M., Nevima, J., & Turečkova, K. (2022). Implementation of a navigation system: Economic verification in a local hospital. PLoS One, 17(10), e0276996. https://doi.org/10.1371/journal.pone.0276996

McNulty, M. J., Kelada, K., Paul, D., Nandi, S., & McDonald, K. A. (2021). Techno-economic process modelling and Monte Carlo simulation data of uncertainty quantification in field-grown plant-based manufacturing. *Data in Brief, 38,* 107317. https://doi.org/10.1016/j.dib.2021.107317

Ministerio de Desarrollo Agrario y Riego [MIDAGRI] (2024). *Boletín Estadístico Mensual El Agro en Cifras – mayo 2024.* Dirección General de Estadística, Seguimiento y Evaluación de Políticas.

Ministerio de Desarrollo Agrario y Riego [MIDAGRI] (2025). Boletín estadístico mensual "El agro en cifras" - 2024 [Boletín]. https://www.gob.pe/institucion/midagri/informes-publicaciones/5380407-boletin-estadistico-mensual-el-agro-en-cifras-2024

Ministerio del Ambiente [MINAM]. (2019). Línea de base de la alfalfa con fines de bioseguridad en el Perú. MINAM. https://bioseguridad.minam.gob.pe/wp-content/uploads/2020/02/estudio_lb_alfalfa.pdf

Oktoviany, P., Knobloch, R., & Korn, R. (2021). A machine learning-based price state prediction model for agricultural commodities using external factors. *Decisions in Economics and Finance, 44(*2), 1063-1085. https://doi.org/10.1007/s10203-021-00354-7

Pawlak, M. (2024). Valuation of real options using Monte Carlo simulation. *Procedia Computer Science, 246,* 3410-3419. https://doi.org/10.1016/j.procs.2024.09.216

Quispe-Guevara, R. Q. (2022). Producción De Medicago Sativa (Alfalfa), Aplicando Abonos Orgánicos En Época De Invierno. *Revista de Investigaciones, 11*(1), 55-67. https://doi.org/10.26788/riepg.v11i1.3564

Rahaman, S. U., & Abdul, M. J. (2025). Quantifying uncertainty in economics policy predictions: A Bayesian & Monte Carlo based data-driven approach. *International Review of Financial Analysis, 102*, 104157. https://doi.org/10.1016/j.irfa.2025.104157

Ríos-Flores, J. L., Ruiz-Torres, J., Cisneros-Vázquez, J. M., Cantú-Brito, J. E., Torres-Moreno, M., & Quiñones, A. M. (2008). Producción, productividad y rentabilidad de la alfalfa (Medicago sativa L) irrigada por bombeo en la Comarca Lagunera de 1999 a 2005. *Revista Chapingo-Serie Zonas Áridas VII (2). Universidad Autónoma Chapingo. Texcoco Edo. De México.*

Roberts, M., Hawes, C., & Young, M. (2023). Environmental management on agricultural land: Cost benefit analysis of an integrated cropping system for provision of environmental public goods. *Journal of Environmental Management, 331*, Article 117306. https://doi.org/10.1016/j.jenvman.2023.117306

Sarmiento, N. (2023). Uso de abonos orgánicos e implicancia en el cultivo de cacao (Theobroma cacao L.) en la provincia de San Martín 2022. Tesis pregrado

Sistema Integrado de Estadísticas Agrarias [SIEA]. 2025. Perfil Productivo Regional.

Sokolov, M. V. (2024). NPV, IRR, PI, PP, and DPP: A unified view. Journal of Mathematical *Economics, 114,* 102992. https://doi.org/10.1016/j.jmateco.2024.102992

Traverso, L., Mazzoli, E., Miller, C., Pulighe, G., Perelli, C., Morese, M. M., & Branca, G. (2021). Cost Benefit and Risk Analysis of Low iLUC Bioenergy Production in Europe Using Monte Carlo Simulation. *Energies, 14*(6), 1-18. https://doi.org/10.3390/en14061650

Trejo-Pech, C. O., Rodríguez-Magaña, A., Briseño-Ramírez, H., & Ahumada, R. (2024). A Monte Carlo simulation case study on blueberries from Mexico. *International Food and Agribusiness Management Review, 27*(2), 359-377. https://doi.org/10.22434/IFAMR2023.0052

Vilani, L., Zanin, A., Lizot, M., Trentin, M., Afonso, P., & Lima, J. (2024). A Framework for Investment and Risk Assessment of Agricultural Projects. *Journal of Risk and Financial Management, 17*(9), 378. https://doi.org/10.3390/jrfm17090378

Yao, X., Qian, L., Changhui, L., & Yi, S. (2022). Effects of altitude and varieties on overwintering adaptability and cold resistance mechanism of alfalfa roots in the Qinghai–Tibet Plateau. *Journal of the Science of Food and Agriculture, 103*(3), 1001–1012. https://doi.org/10.1002/jsfa.12407

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Evolution of Scientific Knowledge on the Monarch Butterfly Biosphere Reserve

Evolución del conocimiento científico sobre la Reserva de la Biosfera de la Mariposa Monarca

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Abstract

This study presents a comprehensive overview of scientific research conducted in the Monarch Butterfly Biosphere Reserve (MBBR) by identifying patterns, trends, and thematic areas of knowledge developed between 1997 and April 2025. A bibliometric analysis was conducted using data from the Web of Science and Scopus databases, considering indicators such as scientific output, citation patterns, author and institutional productivity, and keyword co-occurrence. Descriptive statistics and thematic mapping were used to examine the evolution of research, as well as the most influential countries, institutions, authors, and journals. A total of 106 unique articles were identified, showing a sustained growth in scientific production; 2020 was the most productive year and 2014 the most cited. Mexico leads scientific output, followed by the United States and Canada, with the National Autonomous University of Mexico (UNAM) standing out as the most productive institution. The thematic analysis identified six main research domains: conservation and environmental management, socioeconomic aspects and governance, forest ecology, research methodologies, monarch butterfly biology, and climatic and hydrological phenomena. Although limited to WoS and Scopus, the study provides key evidence to inform conservation policies and strengthen the sustainable management of the MBBR.

Keywords: Monarch Butterfly; natural protected areas; Conservation and Sustainability; Biodiversity management; bibliometrics analysis.

JEL Codes: Q01, Q23, Q54, Q56, Q57, C80.

Resumen

Este estudio presenta una visión integral de la investigación científica realizada en la Reserva de la Biosfera de la Mariposa Monarca (RBMM) mediante la identificación de patrones, tendencias y áreas temáticas del conocimiento desarrolladas entre 1997 y abril de 2025. Se llevó a cabo un análisis bibliométrico a partir de datos de las bases Web of Science y Scopus, considerando indicadores como producción científica, patrones de citación, productividad de autores e instituciones y coocurrencia de palabras clave. Se utilizaron estadísticas descriptivas y mapas temáticos para examinar la evolución de la investigación, así como los países, instituciones, autores y revistas más influyentes. Se identificaron 106 artículos únicos, evidenciando un crecimiento sostenido de la producción científica; 2020 fue el año más productivo y 2014 el más citado. México encabeza la producción científica, seguido por Estados Unidos y Canadá, destacando la UNAM como la institución más productiva. El análisis temático identificó seis dominios principales: conservación y gestión ambiental, aspectos socioeconómicos y gobernanza, ecología forestal, metodologías de investigación, biología de la mariposa monarca y fenómenos climáticos e hidrológicos. Aunque limitado a WoS y Scopus, el estudio aporta evidencia clave para orientar políticas de conservación y fortalecer la gestión sostenible de la RBMM.

Palabras Clave: Mariposa Monarca; áreas naturales protegidas; Conservación y Sostenibilidad; Gestión de la Biodiversidad; análisis bibliométrico.

Códigos JEL: Q01, Q23, Q54, Q56, Q57, C80.

1. INTRODUCTION

Global biodiversity faces unprecedented threats due to numerous anthropogenic factors, such as habitat destruction, pollution, climate change and the introduction of invasive species. Industrial development has caused significant habitat loss, with approximately 24% of terrestrial ecosystems becoming increasingly modified between 1990 and 2020 (Theobald et al., 2025), and almost 25% of species are now at risk of extinction as a result of habitat fragmentation and degradation (Ramm et al., 2025). Pollution from various sources, such as air, water and soil, exacerbates biodiversity loss by directly damaging ecosystems and species (Singh, 2024). Climate change, particularly rising temperatures, poses a significant future threat to biodiversity by affecting the distribution and survival of species (Ramm et al., 2025). The introduction of non-native species also disrupts local ecosystems and often leads to the extinction of native species (Singh, 2024). Finally, human dietary habits, such as meat consumption, contribute to habitat degradation and predation, which also threaten biodiversity (Toibay et al., 2023). For all these reasons, it is essential to analyze how these phenomena are reflected in specific areas, particularly in protected natural areas with high ecological and cultural value.

Understanding the situations that threaten biodiversity has led to the creation of various conservation strategies. Among these strategies, biosphere reserves represent a model of territorial management, as well as being consolidated as living laboratories that seek to reconcile biodiversity conservation and sustainable development of local communities. These spaces are learning environments for sustainable development, where interdisciplinary approaches are applied to understand and manage the interactions between social and ecological systems, including conflict prevention and biodiversity management (UNESCO, 2025a). Biosphere reserves integrate local communities, customs, culture and heritage, promoting cultural diversity. Therefore, their importance lies in their role in preserving biodiversity, promoting sustainable development and enhancing a sense of belonging and pride among local inhabitants, in addition to supporting tourism development, which is vital for economic growth and the preservation of cultural heritage in these unique ecosystems (Stojanović et al., 2024).

Biosphere reserves are ecosystems typical of different biogeographical regions designated under UNESCO's Man and the Biosphere (MAB) Program, whose status is internationally recognized, although they remain under the sovereign jurisdiction of the countries where they are located (Stojanović et al., 2024). Their structure, consisting of core zones (strict protection), buffer zones (activities compatible with ecological practices) and transition zones (sustainable economic activities), allows for the implementation of a management model that reconciles conservation and development (Stojanović et al., 2024), effectively protecting biodiversity and achieving sustainable land use (Samways et al., 2024). The World Network of Biosphere Reserves covers over 7,442,000 km² in 134 countries, home to approximately 275 million inhabitants (Stojanović et al., 2024).

Among Mexico's biosphere reserves, the Monarch Butterfly Biosphere Reserve (MBBR) is unique both nationally and internationally, as no other area has such a high concentration of butterfly populations (Martínez & Chávez, 2022). This territory was initially established as a wildlife reserve and refuge in 1980, later declared a protected natural area in 1986, with an area of 16,100 hectares, and finally upgraded to biosphere reserve status in 2000, expanding its total area to 56,259 hectares, of which 13,551 hectares correspond to the core zone (Champo-Jiménez et al., 2012). The MBBR is located on the border of the states of Mexico and Michoacán, in central Mexico and in the western part of the Central Trans-volcanic Belt (Brenner, 2006); it covers seven municipalities in the state of Michoacán (Angangueo, Aporo, Contepec, Ocampo, Senguio, Tlalpujahua, and Zitácuaro) and four in the state of Mexico (Donato Guerra, San Felipe del Progreso, Temascalcingo, and Villa Allende (Vicente, 2020).

The MBBR, located in the Trans-volcanic Belt, has an ideal microclimate that ensures the survival of millions of monarch butterflies (Danaus plexippus) during the winter (Xu, 2022). On average, each year the overwintering colonies occupy around 2.72 hectares (Rendón-Salinas et al., 2023). The ecological importance of the MBBR lies not only in being the most important overwintering site for the species, but also in the role of its mature oyamel and pine forests in climate regulation, water catchment and erosion prevention.

In terms of conservation efforts, the reserve has made remarkable progress: between 2001 and 2012, large-scale illegal logging was reduced by approximately 98% thanks to collaborative monitoring and management strategies (Flores-Martínez et al., 2019). Similarly, mechanisms such as the Monarch Fund have encouraged the participation of local communities, although the support does not always cover opportunity costs (Catalan, 2015).

Despite this, the MBBR continues to face significant challenges. Between 2012 and 2018, 163.44 hectares were affected by deforestation caused by both illegal activities and natural factors (Flores-Martínez et al., 2019). These problems are aggravated by socioeconomic conditions that limit the effectiveness of management and the search for sustainable development alternatives in communities linked to the reserve (Xu, 2022). In this regard, the MBBR is a paradigmatic example of the challenges of balancing conservation, local governance and community well-being.

The creation of this protected area responds mainly to the need to safeguard the migratory phenomenon of the monarch butterfly (Danaus plexippus) and its overwintering areas (Solution for Sustainable Development, n.d.). Every year, this lepidopteran undertakes one of the most astonishing migrations in the animal kingdom by travelling thousands of kilometers from Canada and the United States to the temperate forests of central Mexico, where it forms overwintering colonies in the oyamel fir (*Abies religiosa*) and other tree species (Commission for Environmental Cooperation, 2017). The migratory phenomenon of the monarch butterfly is an outstanding natural treasure, which is why the Monarch Butterfly Biosphere Reserve was registered in 2008 on UNESCO's World Heritage List (UNESCO, 2025b). In addition to protecting the monarch butterfly and its migration, the MBBR is home to remarkable biological diversity, including endemic species of birds, mammals, plants and organisms such as salamanders, axolotls, wildcats and other species subject to special protection (Solution for Sustainable Development, n.d.). The MBBR also serves as an important aquifer for Toluca and the Mexico City Valley, highlighting its dual role in biodiversity conservation and water resource management, which are essential for both ecological health and the sustainability of local communities (Catalán, 2015).

With regard to tourism, according to data from SEMARNAT and CONANP (2019), the MBBR is visited by over 100,000 tourists during the November to March season, while tourism activity comes to a standstill during the rest of the year (Esquivel et al., 2014). There is little international tourism, mainly due to its distance from the main Mexican tourist destinations, and domestic tourists come mainly from nearby areas in the center and west of the country, such as Mexico City, the State of Mexico and Michoacán (Godínez et al., 2018). There are currently six access points open to the public that have official permits to provide tourist services: El Rosario (Ocampo municipality, Michoacán), Sierra Chincua (Angangueo, Michoacán), El Capulín (Donato Guerra municipality, State of Mexico), La Mesa (San José de Rincón, State of Mexico) (Brenner, 2006), Macheros (Donato Guerra municipality, State of Mexico), and Senguio (Senguio, Michoacán) (Godínez et al., 2018). El Rosario sanctuary is the most visited area of the Reserve (Castañeda et al., 2021), home to the largest colony of monarch butterflies, which is why part of its territory is included in the core zone of the reserve (Ibarra García, 2011). It has tourist infrastructure and services such as food stalls, handicraft sales, guided tours, horse rentals, parking lots, restrooms and visitor centers, which are open during the season (Brenner, 2006).

On the other hand, the sustainability of the MBBR is faced by threats such as changes in land use, including deforestation and agricultural expansion, which have affected the ecological integrity of the reserve, leading to an increase in landslides and habitat degradation (López-García & Alcántara-Ayala, 2012). Several studies have documented forest degradation processes within the reserve and associate this environmental deterioration with factors such as illegal logging, forest fires, forest pests, agricultural expansion and demographic pressure (Champo-Jiménez et al., 2012). In addition, low food production and the degradation of natural resources, resulting in erosion, nutrient loss, and contamination of soil and groundwater due to the excessive use of agrochemicals, have contributed to problems of malnutrition and poor eating habits among the local population. This situation has forced farmers to buy food previously produced by them, thereby increasing their dependence on external markets and their economic vulnerability (Solution for Sustainable Development, n.d.). The loss of forest cover not only affects the monarch butterfly's overwintering habitat, but also jeopardizes the ecological integrity of the ecosystem and the environmental services it provides.

Tourism, along with illegal logging, agricultural expansion and forest pests creates constant tension between conservation, resource use and local development, making the MBBR a privileged laboratory for studying the relationship between biodiversity, community governance and sustainability.

In this context, scientific literature on MBBR has grown in a fragmented way, with contributions coming mainly from ecology, forestry, community governance and sustainable tourism. However, most of these studies have addressed specific issues, such as forest cover loss (Champo-Jiménez et al., 2012), illegal logging (Navarrete et al., 2011), tourism impact (Esquivel et al., 2014) or the social perception of conservation policies [26], without providing a comprehensive overview of the scientific field as a whole. Until now, previous research has not incorporated a comparative and systematic approach that simultaneously integrates thematic trends, collaboration networks, and productivity patterns, which limits the overall understanding of scientific development on MBBR.

At the international level, there are bibliometric analyses of protected natural areas and biosphere reserves (Kratzer, 2018; Martínez-Vega et al., 2022; Silva et al., 2023; Ospino et al., 2024; Pérez-Romero et al., 2025), which have proven useful for identifying key actors, collaboration dynamics and thematic trends.

In addition, recent bibliometric analyses applied to the conservation of migratory species and related environments show methodological approaches that are useful for our study. Li et al. (2025) analyze thematic developments in waterfowl conservation, identifying migratory birds and citizen science as emerging areas in the literature. In another study, Steven & Castley (2021) examines how scientific production in birdwatching tourism has grown, highlighting trends in conservation linked to nature tourism. Similarly, Silva et al. (2023) provide a comprehensive overview of nature-based tourism within protected areas, which is a topic closely connected to the ecosystem services present in the MBBR. This international background not only highlights the usefulness of bibliometrics for identifying actors and trends, but also the need to apply it specifically to the case of the Monarch Butterfly Biosphere Reserve.

This type of bibliometric analysis for the MBBR is particularly relevant in practical terms: its results can guide the formulation of public conservation policies in Mexico by identifying scientific gaps and key actors; provide evidence for adaptive management of the reserve; and promote its alignment with international conservation standards. Furthermore, given its status as a UNESCO-recognized site, the study provides exportable inputs for the World Network of Biosphere Reserves, reinforcing its position as a model for other protected areas seeking to balance conservation, culture, tourism and sustainability.

However, to date, no specific bibliometric study has been developed for the MBBR, which constitutes a knowledge gap, considering the importance of this site as a natural and cultural heritage site. This gap is particularly relevant, as the MBBR is the subject of an increasing volume of publications in different disciplines. However, there is no systematic overview that allows for an assessment of the level of scientific development achieved, academic collaboration networks and outstanding research priorities. This type of analysis not only strengthens academic knowledge but can also serve as input for decision-makers, conservation managers and international organizations interested in the sustainability of the reserve.

Beyond the absence of a bibliometric synthesis, there is also a conceptual gap regarding how the diverse ecological, social and governance-oriented studies on the MBBR interact, overlap or remain fragmented within the broader scientific field. Addressing this gap is essential to understand whether the evolution of research reflects an integrated socio-ecological perspective or, conversely, a disciplinary compartmentalization that may limit holistic conservation strategies. In this sense, a systematic analysis of scientific production is not merely descriptive, but contributes to evaluating the degree to which knowledge generation supports multilevel governance and adaptive management across the monarch butterfly's migratory system.

The overall objective of this research project is to conduct a bibliometric analysis of the scientific literature on the MBBR in order to define its evolution, productivity and impact, as well as to identify the main actors and thematic trends in research based on the Web of Science (WoS) and Scopus databases. These two sources were selected due to their broad and standardized coverage, as well as their established use in international scientific evaluation studies, which allows for methodologically robust comparisons and replicable results. Specifically, this study seeks to:

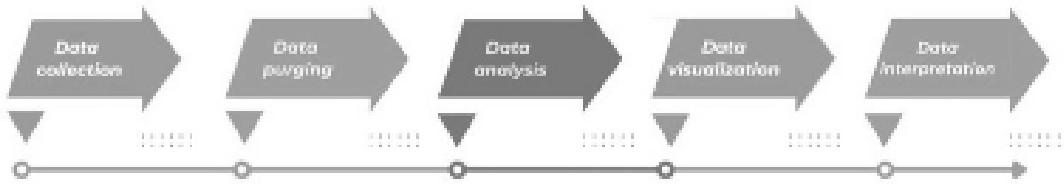
- Quantify the overlap and uniqueness of scientific literature on MBBR between the WoS and Scopus databases.
- Analyze the temporal evolution of productivity (number of publications) and influence (number of citations) of research related to MBBR.
- Identify the most influential (cited) documents on MBBR.
- Determine the most productive and influential authors in the field of MBBR.
- Identify the countries and academic institutions with the greatest contribution to publications on MBBR.
- Determine the journals with the highest number of publications on MBBR, evaluating their quartile and impact factor/SJR.
- Analyze the most frequently used keywords by authors in publications on MBBR in order to identify thematic trends.

The article is organized into five sections. Section 1 lays the conceptual and contextual foundations of the study, providing the background, rationale and research objectives. Section 2 then describes the methods used for data collection and processing. The main findings of the study are presented in Section 3, which is structured into several subsections for better understanding. Section 4 discusses these results, contrasting them with the existing literature, and finally, Section 5 summarizes the conclusions drawn from the work. In this way, this article offers the first systematic overview of scientific production on the MBBR, providing evidence for researchers, managers and decision-makers interested in ensuring the long-term conservation of this natural heritage.

2. METHODOLOGY

The to address the objectives set out in this research, a bibliometric analysis was carried out following the five steps shown in Figure 1.

Figure 1. Steps in bibliometric analysis.



Source: Pérez-Romero et al. (2025)

To accomplish step 1, data collection, we began by defining the database to be used. Álvarez et al. (2018) point out that bibliographic databases play a key role in bibliometric research, as they allow for the analysis of scientific activity carried out by researchers, centers, regions and countries in order to detect their strengths and weaknesses and identify trends in research. To carry out this analysis, both WoS and Scopus were used. WoS is a platform created in 1960 and owned by Thomson Reuters (Álvarez-García et al., 2018), while Scopus is a multidisciplinary, international bibliographic database of scientific literature created by Elsevier in November 2004 (Durán-Sánchez et el., 2017). Both databases provide comprehensive coverage of high-quality peer-reviewed academic literature (Serrano Junco et al., 2023); Scopus provides broader coverage and more exclusive documents on tourism and community participation research, while WoS is known for its citation metrics (Salouw et al., 2024). Their importance lies in their ability to enhance the visibility and impact of research, support meta-analyses and track citation trends in various disciplines (Zhu & Liu, 2020). Both databases have become the primary sources of publication metadata and bibliometric indicators. Their combined use is widely recommended in bibliometric research to enhance data reliability, reduce database-specific bias, and increase coverage robustness (Sabando-Vera et al., 2025; Morante-Carballo et al., 2023).

The period analyzed was 1997–April 2025, which was selected because it corresponds to the years when MBBR was most firmly established as a biosphere reserve and world heritage site. The initial year (1997) is justified because it was during this period that the first indexed article on the MBBR appeared in international databases, representing the documented beginning of scientific production. Only scientific articles and reviews published in peer-reviewed journals were included, without language restrictions, although most of the documents are in English and Spanish. Books, book chapters, conference proceedings, and gray literature were excluded to ensure consistency in the quality of the sources. In addition, only studies whose research question, empirical evidence, or conceptual contribution explicitly addressed the MBBR were retained to ensure thematic relevance.

The search criteria were then defined, as shown in Table 1. The search was conducted on May 1, 2025. A total of 136 results were identified in WoS and 99 in Scopus.

Table 1. Search criteria.

WoS	TOPIC "Biosphere AND reserv* AND butterfl* AND monarch" OR "Reserva AND biosfera AND mariposa* AND monarca"
Scopus	ARTICLE TITLE, ABSTRACT, KEYWORDS "Biosphere AND reserv* AND butterfl* AND monarch" OR "Reserva AND biosfera AND mariposa* AND monarca"

Source: own elaboration

To perform data purging (step 2), the title and abstract of all the results obtained in step 1 were read out. Studies that were duplicates in the same database and those that mentioned MBBR only as a reference, but whose research focused on another topic were eliminated. Two researchers carried out the selection process independently and compared results to reduce bias. Any discrepancies between reviewers were resolved through discussion until consensus was reached, ensuring a consistent and transparent selection process. In addition, a standardization process was carried out for the names of authors, institutions and countries to avoid duplication (for example, “UNAM” and “Universidad Nacional Autónoma de México” were treated as the same record), following the methodological recommendations by Donthu et al. (2021). A total of 97 valid results were identified in WoS and 78 in Scopus, which were used to conduct the bibliometric study.

Excel and WordClouds were used to analyze and visualize the data, considering the following research questions, which helped to guide the work towards achieving the objectives proposed. VOSviewer (van Eck & Waltman, 2010) was also used to create maps of co-authorship, co-citation and keyword co-occurrence networks. In addition, Bibliometrix (Aria & Cuccurullo, 2017) was used as a tool for statistical analysis of scientific output. This combination of tools made it possible to integrate a performance analysis (productivity and citations) with a relational analysis (scientific collaboration, thematic networks), increasing the robustness and triangulation of the results in comparison with methodologies based on a single tool.

Based on the methodological approach described above, the following research questions (RQ1–RQ7) were formulated to structure the analysis and guide the empirical assessment of the literature on MBBR:

RQ1: What is the overlap of the literature on MBBR in the WoS and Scopus databases?

RQ2: What have the evolution and changes in the productivity and influence of research on MBBR been?

RQ3: What are the most influential documents on the subject (most cited documents)?

RQ4: Who are the key authors in the field of study covered by this analysis?

RQ5: Which countries and universities have the highest number of publications?

RQ6: Which journals have the highest number of publications? In which quartile are the journals ranked and what is their impact factor?

RQ7: What are the keywords most used by authors in their publications?

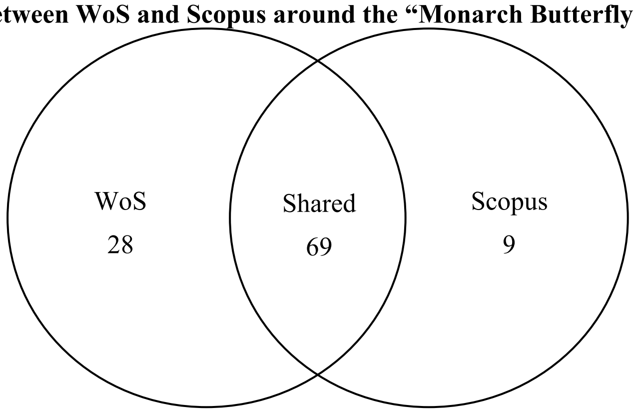
3. RESULTS

3.1. Overlap in databases

In order to quantify the overlap, or in other words, the uniqueness of scientific literature, the WoS and Scopus databases were compared. This comparison was based on overlap calculations such as Meyer´s Index, Traditional Overlap (TO) and Relative Overlap, as proposed by Durán et al. (2017). The combination of these three indicators provides a more complete picture: while Meyer´s Index measures the relative singularity of each database, Traditional Overlap estimates the overall level of overlap, and Relative Overlap shows the coverage capacity of one database in relation to the other. Furthermore, the joint selection of these three indicators is based on their recurring use in comparative studies between scientific databases, which allows maintaining methodological consistency with previous research in related areas.

The identification process resulted in 97 articles in WoS and 78 in Scopus, amounting to a total of 175 articles. After removing duplicates, 69 repeated articles were identified, resulting in 106 unique articles; 28 of these unique articles were found only in WoS, while 9 were found only in Scopus (Figure 2). Figure 2, represented as a Venn diagram, visually illustrates this distribution, showing the intersection of common documents and the proportion of unique articles in each database. These data reveal that although there is a significant overlap of 65.09% between the databases, the complementarity of 34.91% of unique documents justifies the relevance of using both sources for the present bibliometric analysis. In comparative terms, these percentages are in line with bibliometric studies on conservation and sustainable tourism, which have reported overlaps of 60–70% between both platforms, confirming that no single database is sufficient on its own to capture all relevant scientific production (Mongeon & Paul-Hus, 2016; Martín-Martín et al., 2018).

Figure 2. Overlap between WoS and Scopus around the "Monarch Butterfly Biosphere Reserve".



Source: Own elaboration

The Meyer Index is a measure used to evaluate the coverage of a database on a specific topic (Pulgarín & Escalona, 2007). Its calculation, shown in Formula 1, assigns greater weight to unique document, those present in a single database, and progressively reduces this weight for duplicate documents (weight = 0.5), triplicate documents (weight = 0.3), and so on, depending on the total number of databases compared (Durán et al., 2017). A higher Meyer's Index value indicates greater singularity of the database, meaning that it contains a higher proportion of unique documents (Costas et al., 2008).

$$Meyer\ Index = \frac{\sum Sources * Weight}{Total\ Sources} \quad (1)$$

Table 2 shows the results of the Meyer Index. The analysis revealed that WoS has a higher singularity in the retrieval of articles related to the topic of MBBR, with 28.87% of unique content. This result is reflected in a Meyer Index of 0.64. Scopus, on the other hand, has 11.54% unique content, resulting in a Meyer Index of 0.56. Although the numerical difference between the two indices may seem small (0.08), in practical terms, it reflects that WoS provides a broader set of unique articles, especially in historical ecology and conservation journals, while Scopus is stronger in recent publications and applied disciplines such as tourism and social sciences.

Table 2. Unique articles of WoS and Scopus

Databases	Percentage Single	Meyer´s Index
WoS	28.87%	0.64
Scopus	11.54%	0.56

Source: Own elaboration

To complement the evaluation of overlap between databases, Traditional Overlap (TO) was applied, a measure proposed by Gluck (1990) and expressed in Formula 2. This index quantifies the percentage of documents common between two databases (A and B), such that a higher TO value indicates a greater level of similarity between them (Durán-Sánchez et al., 2017). In the analysis, the traditional overlap calculated was 65.09%. This result reflects a remarkable similarity between the articles indexed in WoS and Scopus, indicating that a considerable percentage of the literature is found on both platforms. Therefore, the remaining 34.91% represents unique or non-overlapping content, i.e., the disparity between the two databases.

$$\%TO = 100 * \left(\frac{|69|}{|97 + 78 - 69|}\right)$$

$$\%TO = 65.09\% \quad (2)$$

Finally, Relative Overlap was also used as another way to evaluate the overlap between databases. This measure, originally proposed by Bearman and Kunberger (1977) and shown in formula 3, measures the percentage by which one database (A) covers another (B), and the result is interpreted as the level of coverage of A over B (Durán-Sánchez et al., 2017). In this study, Scopus covers 88.46% of WoS articles, while WoS covers Scopus by 71.13%. These differences in article overlapping can be attributed to the different indexing policies of each database but are mainly explained by the discrepancy in the total number of journals that each one collects (Durán-Sánchez et al., 2020) This pattern indicates that although Scopus manages to capture a larger proportion of the documents contained in WoS, the latter continues to offer a significant set of unique, high-value articles, particularly in historical ecology and conservation journals. The observed complementarity demonstrates that an analysis based exclusively on a single database would lead to an incomplete picture, affecting the identification of trends and key actors in MBBR research.

$$
\begin{aligned}
\%\ Overlap\ in\ A &= 100 * \left(\frac{|A \cap B|}{|A|}\right) \\
\%\ Overlap\ in\ B &= 100 * \left(\frac{|A \cap B|}{|B|}\right) \\
\%\ Overlap\ WoS &= 100 * \left(\frac{|69|}{|97|}\right) = 71.13\% \\
\%\ Overlap\ Scopus &= 100 * \left(\frac{|69|}{|78|}\right) = 88.46\%
\end{aligned}
\tag{3}
$$

The results confirm that combining both databases is essential to obtain a comprehensive overview of scientific production on MBBR. Hereafter, all analyses are based on the purged set of 106 unique articles, which ensures the robustness of the findings presented.

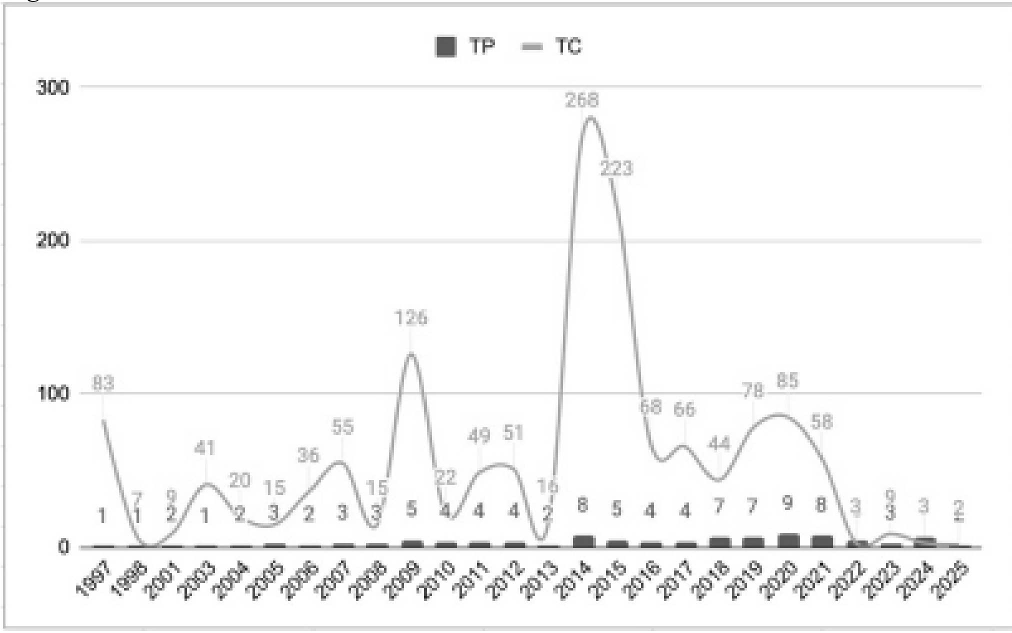
3.1. Productivity and influence

Figure 3 shows the evolution of scientific productivity on MBBR, measured in number of publications per year, as well as the volume of citations received. The temporal analysis enables to identify both the consolidation of the field and the existence of periods of particular dynamism. The first article identified on MBBR was published in 1997 and entitled "Use of lipid reserves by monarch butterflies overwintering in Mexico: Implications for conservation". The study by Alonso Mejía et al. (1997), published in Ecological Applications, examined whether greater nectar availability could reduce lipid depletion in monarch butterflies during the overwintering period. The authors suggested that increased floral resources might enhance survival, which was used to justify tree felling in the MBBR to create forest clearings where more plants could bloom. They found that clustered butterflies had significantly higher lipid mass, water content, lean mass and wings than monarchs collected from flowers; differences that remained constant throughout the overwintering period. Therefore, they concluded that it is not necessary to create open areas in the core zones of the MBBR to stimulate flower production for monarchs overwintering in Mexico and that an intact, closed forest is necessary for successful overwintering because it allows monarchs to conserve their lipid reserves for spring migration (Alonso-Mejia et al., 1997). This groundbreaking work was the beginning of indexed scientific literature on the MBBR, establishing a sound ecological basis for future research.

From a comparative perspective, the growth in publications on MBBR reflects the global trend of expansion in scientific literature on biodiversity conservation and protected areas, which has shown steady growth since the 2000s (Li et al., 2025; Steven & Castley, 2021).

Figure 3 shows that the highest number of articles published per year on MBBR is 9, corresponding to the year 2020. This peak coincides with a period in which academic debates on climate change and the conservation of migratory species intensified, positioning the monarch butterfly as an emblematic case in scientific discourse. The year 2014 also stands out, with the highest number of citations, 268, accumulated among the eight articles identified in that year. This increase is mainly due to two articles by Vidal et al. (2014), which analyzed population trends and deforestation, becoming key references for subsequent research. The 106 articles analyzed have accumulated 1,452 citations. In relative terms, this volume of citations reflects a field that is still emerging, but with high-impact articles that attract a great deal of academic attention.

Figure 3. Evolution of the number of articles and citations on MBBR. Source: Own work.



3.3. Most cited articles

Table 3 shows the ranking of the 10 most cited articles related to the subject of analysis. In the first position, with 198 citations and indexed only in WoS, is the article "Unravelling the annual cycle in a migratory animal: breeding-season habitat loss drives population declines of monarch butterflies", written by Flockhart, D. T. Tyler; Pichancourt, Jean-Baptiste; Norris, D. Ryan; Martin, Tara G. and published in the Journal of Animal Ecology in 2015. This document is also classified as the article with the highest average number of citations per year (19.8), which positions it as the most influential publication on the subject. In general, the most cited articles are divided into three main thematic areas: (i) ecology and biology of the monarch butterfly (e.g., Alonso et al. (1997); Flockhart et al. (2015), (ii) conservation and forest management (e.g., Vidal et al. (2014); Navarrete et al. (2011) and (iii) social and governance aspects (e.g., Brenner (2009); Honey-Rosés et al. (2009)). This thematic diversity highlights the interdisciplinary nature of research on MBBR.

A prominent pattern is that the articles with the greatest impact not only provide local diagnoses of MBBR, but have also been cited as paradigmatic cases in international discussions on the conservation of migratory species, the effectiveness of payment programs for environmental services, and the interaction between local communities and environmental policies.

Furthermore, the fact that several of the most influential articles were published in 2014–2015 reinforces the idea that this period was a turning point in academic production on MBBR, establishing lines of research that are still relevant today.

Table 3. Ranking of the most cited articles on MBBR

R	Article	Authors	Publication Year	Scopus		WoS		Main Results
				C	C/Y	C	C/Y	
1	Unravelling the annual cycle in a migratory animal: breeding-season habitat loss drives population declines of monarch butterflies	Flockhart, D. T. T., Pichancourt, J., Norris, D. R., & Martin, T. G.	2015	-	-	198	19.8	The study sought to understand the causes of the monarch butterfly's decline. It revealed that the primary factor behind the decline in the monarch butterfly population is the reduction of milkweed in the United States, due to the increasing adoption of genetically modified crops and changes in land use, and not climate change or the degradation of forest habitats in Mexico. Therefore, the conservation priority is to protect and restore milkweed in North American breeding grounds.
2	Dynamics and trends of overwintering colonies of the monarch butterfly in Mexico	Vidal, O., & Rendón-Salinas, E.	2014	125	11.4	118	10.7	This study, which monitored monarch butterfly colonies in Mexico from 2004 to 2014, revealed a critical decline in the overwintering habitat. The area occupied by monarchs fell to 0.67 hectares in 2013-2014, the lowest figure in two decades. This decline is attributed to the loss of milkweed in the U.S., climate change and deforestation in Mexico, as well as unregulated tourism. The study highlights the urgency of protecting and restoring overwintering sites in Mexico and habitat along the entire migratory route in North America.
3	Trends in Deforestation and Forest Degradation after a Decade of Monitoring in the Monarch Butterfly Biosphere Reserve in Mexico	Vidal, O., López-García, J., & Rendón-Salinas, E.	2014	105	9.5	96	8.7	The study aimed to monitor forest cover in the Monarch Butterfly Biosphere Reserve in Mexico and evaluate the effectiveness of conservation actions. The main findings showed that between 2001 and 2012, 2,179 hectares were affected, mainly by illegal logging (2,057 ha). Although efforts by authorities and financial support had succeeded in eliminating large-scale illegal logging by 2012, small-scale logging is still a growing concern. The study concludes that despite progress, socioeconomic problems that require a regional sustainable development strategy for long-term conservation persist.
4	Use of lipid reserves by monarch butterflies overwintering in Mexico: Implications for conservation	Alonso-Mejia, A., Rendon-Salinas, E., Montesinos-Patino, E., & Brower, L. P.	1997	97	3.5	83	3	This study investigated whether cutting down trees in the Monarch Butterfly Biosphere Reserve would benefit butterflies by increasing the availability of flowers. The main findings refuted this idea: butterflies clustered in closed forests had higher energy reserves (lipids) and were in better physical condition than those that frequented flowers. Butterflies on flowers, in fact, showed low lipid reserves, suggesting that they might not have enough energy for spring migration. The study concludes that an intact, dense forest is essential for monarchs to conserve their lipids during overwintering in Mexico, preparing them for migration, and conversely, openings in the forest are not beneficial.
5	To pay or not to pay? Monitoring performance and enforcing conditionality when paying for forest conservation in Mexico	Honey-Rosés, J., López-García, J., Rendón-Salinas, E., Peralta-Higuera, A., & Galindo-Leal, C.	2009	66	4.1	56	3.5	This study evaluated the effectiveness of the forest conservation payment program for landowners in the Monarch Butterfly Biosphere Reserve in Mexico, focusing on the reliability of monitoring. The main findings revealed a degradation of 161 hectares of forest between 2001 and 2003, which led to the withholding of payments to one landowner. However, an analysis using high-resolution aerial photographs did not detect changes at a finer scale, suggesting that current programs may be underestimating environmental degradation and overpaying non-compliant participants. The study concludes that it is crucial to improve monitoring methods and establish clear criteria for withholding payments, based on specific policy objectives, until the marginal value of ecosystem services is better understood.

6	Mapping expert knowledge: Redesigning the Monarch Butterfly Biosphere Reserve	Bojórquez-Tapia, L. A., Brower, L. P., Castilleja, G., Sánchez-Colón, S., Hernández, M., Calvert, W., Díaz, S., Gómez-Priego, P., Alcantar, G., Melgarejo, E. D., Solares, M. J., Gutiérrez, L., & Del Lourdes Juárez, M.	2003	50	2.3	41	1.9	The aim of this study was to redesign the Monarch Butterfly Biosphere Reserve (MBBR) in Mexico by using decision analysis and expert consultation to identify optimal overwintering habitats. The results led to the selection of a new core area of 21,727 hectares. This redesign made it possible to accurately locate key habitats and minimize the inclusion of areas of interest to local loggers, thereby improving the conservation and management of the reserve.
7	Logging within protected areas: Spatial evaluation of the monarch butterfly biosphere reserve, Mexico	Navarrete, J.-L., Isabel Ramírez, M., & Pérez-Salicrup, D. R.	2011	37	2.6	38	2.7	The study analyzed the effectiveness of authorized logging versus strict protection in the Monarch Butterfly Biosphere Reserve (MBBR). Key findings showed that while planned authorized logging had a minimal impact (6% of disturbance), illegal logging (61%) and untimely extractions (33%) were the main causes of forest degradation (5,239 hectares between 1993 and 2006). Areas without Forest Management Programs (FMPs) experienced greater deforestation due to land use changes. The study concludes that FMPs are effective in maintaining forest cover and suggests that the analysis method used can be a useful monitoring tool for authorities in supervising logging licenses.
8	Recent evidence of Mexican temperate forest decline and the need for ex situ conservation, assisted migration, and translocation of species ensembles as adaptive management to face projected climatic change impacts in a megadiverse country	Sáenz-Romero, C., Mendoza-Maya, E., Gómez-Pineda, E., Blanco-García, A., Endara-Agramont, A. R., Lindig-Cisneros, R., López-Upton, J., Trejo-Ramírez, O., Wehenkel, C., Cibrián-Tovar, D., Flores-López, C., Plascencia-González, A., & Vargas-Hernández, J. J.	2020	46	9.2	41	8.2	This study aimed to highlight the decline of forests in the Trans-volcanic Belt and the temperate forests of north-western Mexico over the last decade, apparently due to climate change. The main findings include: massive infestation of Pinus hartwegii by mistletoe, insufficient Abies religiosa recruitment in the Monarch Butterfly Reserve, signs of inbreeding and defoliation in endangered Picea species and unusual outbreaks of pests and diseases. It therefore concludes that conservation strategies such as ex situ conservation, assisted migration and species translocation are required to enable Mexico's temperate forests to cope with the impacts of climate change.
9	Acceptance of environmental conservation policies: the case of the Monarch Butterfly Biosphere Reserve	Brenner, L.	2009	-	-	20	1.3	This article analyzed why conservation policies in the Monarch Butterfly Biosphere Reserve (MBBR) in Mexico have limited results. The objective was to identify the reasons for the low acceptance of these policies. The main findings indicate that the complexity of conflicts of interest between local communities and conservation policies is the key factor. Despite management initiatives and attempts to establish negotiation platforms, effective implementation is hindered. In conclusion, the study emphasizes the need to address these conflicts of interest and improve negotiation and coordination strategies to achieve greater acceptance and more robust results in environmental conservation in the MBBR.
10	Population Genetics of Overwintering Monarch Butterflies, Danaus plexippus (Linnaeus), from Central Mexico Inferred from Mitochondrial DNA and Microsatellite Markers	Pfeiler, E., Nazario-Yepiz, N. O., Pérez-Gálvez, F., Chávez-Mora, C. A., Laclette, M. R. L., Rendón-Salinas, E., & Markow, T. A.	2017	31	3.9	29	3.6	This study aimed to evaluate the genetic variation and demographic history of the monarch butterfly in Mexico, comparing migratory and non-migratory populations. The findings show low genetic diversity and significant population structure between migratory and non-migratory monarchs, suggesting limited gene flow between them. Despite this, non-migratory populations in Mexico and Costa Rica shared genetic similarities. Demographic analyses indicate a population expansion at the end of the Pleistocene and a stable effective female population of approximately 6 million over the last 10,000 years.

Source: Own elaboration. R, Ranking; C, Citation; C/Y Citation per year

3.4. Authors

Table 4 shows the five most productive authors: Pérez-Salicrup, Diego R. and Ramírez, M. Isabel with 14 publications; López García José with 12 publications; Rendon Salinas, E. with 10 publications; and Saenz-Romero, Cuauhtemoc with 8 publications. Following Crane (1977), authors were classified according to productivity: high producers are those with more than 10 publications, and moderate producers are those with between 4 and 10 publications. The table also shows that four of the five most productive authors are affiliated with Mexican institutions and one with a Spanish institution. This predominance of Mexican institutions reflects that MBBR continues to be a locally led field of research, although with international connections that are beginning to be consolidated through specific collaborations, particularly in the areas of ecology, genetics and climate change.

Table 4. Top 5 of the most productive authors

Name	Affiliation	Country	TP	FA	TC	TC/TP	Crane
Perez-Salicrup, Diego R.	Universidad Nacional Autónoma de México	Mexico	14	0	205	14.64	High producers
Ramirez, M. Isabel	Universidad Nacional Autónoma de México	Mexico	14	5	185	13.21	High producers
Lopez Garcia, Jose	Universidad Complutense de Madrid	Spain	12	7	248	20.67	High producers
Rendon Salinas, E;	World Wildlife Fund, Terrestrial Ecosystems Program	Mexico	10	2	412	41.20	Moderate producers
Saenz-Romero, Cuauhtemoc	Universidad Michoacana de San Nicolás de Hidalgo	Mexico	8	2	95	11.88	Moderate producers

Source: Own elaboration. TP, Total of publications; FA, First Author; TC, Total of citations; TC/TP, average of citations per publication

Another noteworthy finding is the author transience index, which represents the number of authors who have only one article. In this case, the transience index is 66.81%, which means that the vast majority have contributed one article to the topic. This may be due to the fact that they have recently taken up the topic for research or due to a lack of interest in the same topic after completing a research project. This value is consistent with what has been observed in other bibliometric studies on protected areas, where there is a large base of "occasional" researchers, who complement the core of recurring authors (Mongeon & Paul-Hus, 2016). With regard to the collaboration index, a value of 3.8 was obtained. This data represents the average number of authors per published article, expressed as a percentage, with a collaboration rate of 83.96%. This high degree of collaboration indicates that research on the MBBR is mainly carried out by multidisciplinary teams, which is consistent with the complexity of the environmental and social problems addressed by this reserve. Finally, the productivity index represents the average number of publications per author, for which a value of 1.76 was obtained.

Table 5. Some indicators associated with authorship

Index	Calculation	
Transience Index	Number of authors with a single article published/Total number of authors X 100	66.81%
Collaboration Index or Index of Co-authorship	Number of authorship/Number of articles	3.801886792
Degree of Collaboration	Number of articles with multiple authorship/Total number of articles X 100	83.96%
Productivity Index	Number of authorships/Number of authors	1.759825328

Source: Own elaboration

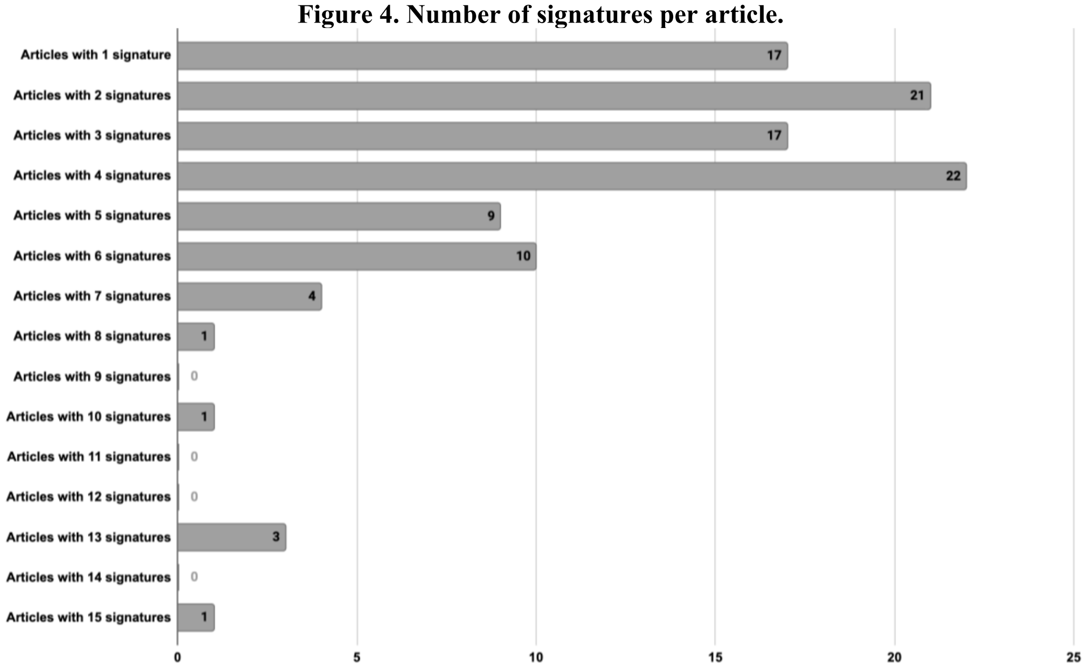
Table 6 shows the classification of authors according to Crane's criteria (1977), and Figure 4 shows the number of signatures per article. It can be seen that 91.7% of authors are considered aspirants, having published 1, 2, or 3 articles. 7.0% of authors are considered moderate authors, having published between 4 and 10 articles on the subject, and finally, only 1.3% are considered high producers, having published more than 11 articles. This pattern of high concentration in a few authors and a majority of aspiring authors is typical of emerging fields: there is a "hard core" of consolidated researchers, who generate most of the knowledge and a broad periphery of collaborators who participate occasionally (Price, 1963). In the case of the MBBR, this core has been fundamental in maintaining long-term monitoring series, without which it would be impossible to understand the population dynamics of the monarch butterfly and the socio-environmental pressures facing its habitat.

Table 6. Classification of authors using the Crane System

NAA	NA	%	Names	Crane
1	153	67.1%	Other authors	Aspirants
2	43	18.9%		
3	13	5.7%		
4	6	2.6%	Alcantara-Ayala, Irasema; Alonso-Mejía, Alfonso; Carlon Allende, Teodoro; Gomez-Pineda, Erika; Jaramillo-López, Pablo; Manzo Delgado, Lilia	Moderate producers
5	5	2.2%	Brower, Lincoln P.; Champo Jimenez, Omar; Lopez-Toledo, Leonel; Martínez Pacheco, Anuar Iram; Mendoza, Manuel E.	
6	3	1.3%	Bianco-Garcia, Arnulfo; Espana Boquera, Ma Luisa; Lindig-Cisneros, Roberto A.	
7	-	-		
8	1	0.4%	Saenz-Romero, Cuauhtemoc	
9	-	-	-	
10	1	0.4%	Rendon Salinas, Eduardo	
11	-	-	-	High producers
12	1	0.4%	Lopez Garcia, Jose	
13	-	-	-	
14	2	0.9%	Perez-Salicrup, Diego R.; Ramírez, M. Isabel	
	228	100%		

Source: Own elaboration. NAA, Number of articles by author; NA, Number of authors.

Figure 4. Number of signatures per article.



Source: Own elaboration

3.5. Productivity by country and institution

In research on the Monarch Butterfly Biosphere Reserve (MBBR), with 148 publications. This predominance is consistent with the location of the Reserve, which naturally drives research by national institutions and scientists. However, research on the MRRB is not limited to the national sphere. The presence of authors affiliated with institutions in the United States (USA), Canada, Spain, France, Colombia, Australia, Chile, Germany, the Netherlands and Norway, indicates growing international involvement in the study and conservation of this natural heritage. This diversity of affiliations suggests global recognition of the MRRB as a relevant subject of study, thus fostering scientific collaboration across borders. It should be noted that although international participation is still limited in volume, it is concentrated in countries that are key to monarch butterfly migration (the United States and Canada), reflecting the need for multinational approaches to the research and conservation of this migratory species.

In addition, a characteristic pattern can be observed in protected natural areas of great ecological importance: there is a highly concentrated core of production in the country hosting the reserve, accompanied by international contributions that are often linked to cooperation projects, joint monitoring and comparative studies. This phenomenon coincides with findings in other bibliometric analyses of biosphere reserves (Silva et al., 2023).

Table 7. Main countries according to the affiliation of their authors.

Ranking	Country	TP	Crane
1	Mexico	148	High producers
2	USA	28	
3	Canada	9	Moderate producers
4	Spain	5	
5	France	3	Aspirants

Source: Own elaboration; TP, Total publications

In terms of productivity per educational institution, Table 8 shows the ranking of the most productive institutions. The leading university in the ranking is the National Autonomous University of Mexico with 59 publications in which it appears in the affiliation, followed by the Michoacan University of San Nicolás de Hidalgo with 16 publications; both universities are considered high producers according to Crane's classification. This institutional leadership reinforces the key role of Mexican public universities in research on MBBR, complemented by the work of non-governmental organizations such as the World Wildlife Fund (WWF), which also ranks among the entities with the highest number of publications. This pattern highlights the importance of cooperation between academia and civil society in generating knowledge applied to conservation.

An additional aspect to consider is institutional concentration: more than 70% of publications come from three Mexican institutions, which may imply a bias in the research agenda towards certain academic perspectives. However, it also represents an opportunity to promote greater institutional and international diversification, thus strengthening the plurality of scientific approaches applied to MBBR.

Table 8. Main universities according to the affiliation of their authors.

Ranking	University	TP	Country	Crane
1	Univ Nacl Autonoma Mexico	59	Mexico	High producers
2	Univ Michoacana San Nicolas de Hidalgo UMSNH	16	Mexico	
3	Universidad Autónoma del Estado de México	9	Mexico	Moderate Producers
	World Wildlife Fund	9	Mexico	
4	Colegio de Postgraduados	8	Mexico	
5	Comis Nacl Conocimiento & Uso Biodiversidad	5	Mexico	
	Inst Nacl Invest Forestal & Agr	5	Mexico	

Source: Own elaboration; TP, Total publications.

3.6. Journals

In relation to the resources used for scientific dissemination, a total of 72 journals that have published articles related to the subject of this analysis were identified. 79.17% of these journals have published only one article, while the remaining 20.83% have contributed two or more publications. For a broader view of the latter group, Figure 5 illustrates the 15 journals with the highest number of articles. This scatter plot confirms Bradford's law of scattering in bibliometrics, whereby a few journals account for most of the scientific production, while the majority contribute only occasional publications (Bradford, 1934).

Table 9 lists the five journals that have published the most articles on the subject, highlighting their impact and positioning. At the top of this list, with seven publications each, we find Madera y Bosques of the Instituto de Ecología A.C. (Q3, SJR 0.244) and Revista Chapingo Serie Ciencias

Forestales y del Ambiente of the Universidad Autónoma de Chapingo (Q3, SJR 0.226). Both Mexican journals are positioned in the third quartile (Q3), indicating their relevance within their categories. Investigaciones Geográficas of the Institute of Geography at the National Autonomous University of Mexico (Q4 and SJR of 0.161) is in the third position, also with seven publications, suggesting a lower impact compared to the previous two. In general, the importance of national publications in disseminating research related to the analysis is highlighted. This predominance of Mexican journals confirms that MBBR has mainly been studied in a local and regional context, which ensures contextual relevance, but limits its visibility in the international scientific community.

Finally, the presence of international journals such as forests (Q1, SJR 0.6) and Journal of Maps (Q2, SJR 0.61) in the 4th and 5th positions, respectively, although with fewer articles in this specific analysis, highlights the relevance of the topic in a global context and the possibility of achieving very high-impact publications. The inclusion of these higher impact factor journals opens up a strategic opportunity to internationalize research on the MBBR and increase its visibility in global debates on biodiversity, climate change, and migratory species conservation. In this regard, targeting future publications towards Q1 and Q2 journals could significantly contribute to reinforcing the international positioning of the MBBR as a benchmark in conservation.

Figure 5. Journals with two or more articles published on the topic of MBBR.

Source: own elaboration using Wordclouds.com

Table 9. Number of articles per journal

R	Journal	TP	Subject Area	Category	Q	SJR 2024	Publisher	Country
1	Madera y bosques	7	Agricultural and biological sciences	Forestry	Q3	0.244	Instituto de Ecología A. C.	Mexico
2	Revista Chapingo Serie Ciencias Forestales y del Ambiente	7	Agricultural and biological sciences	Forestry	Q3	0.226	Universidad Autónoma de Chapingo	Mexico
			Environmental Science	Ecology	Q3			
3	Investigaciones Geograficas	7	Earth and planetary sciences	Earth and planetary sciences (miscellaneous)	Q4	0.161	Instituto de Geografía, UNAM	Mexico
			Social Sciences	Geography, planning and development	Q4			
4	Forests	3	Agricultural and biological sciences	Forestry	Q1	0.6	Multidisciplinary Digital Publishing Institute (MDPI)	Switzerland
5	Journal of Maps	3	Earth and planetary sciences	Earth and planetary sciences (miscellaneous)	Q2	0.61	Taylor and Francis Ltd.	United Kingdom
			Social Sciences	Geography, planning and development	Q2			

Source: Own elaboration. R, Ranking; TP, Total publications; Q, Quartile

3.1. Keywords

In order to visualize and understand the core themes emerging from the research on MBBR, a series of word clouds have been generated from the keywords in the 106 publications analyzed here. Each cloud corresponds to a specific thematic grouping and highlights the relevance of key terms within each domain. It should be noted that the keywords “MBBR, Monarch Butterfly and Mexico” were excluded from this analysis, as they are the core theme of this study and therefore, as expected, these terms appeared many times. Six groups of keywords were formed, named as follows: a) Threats, conservation and environmental management; b) Socioeconomic aspects and governance; c) Ecology and forests; d) Research methodologies and tools; e) Monarch butterfly and its habitat; and f) Climatic and hydrological phenomena.

Figure 6 shows the word clouds.

a) Threats, conservation and environmental management

b) Socioeconomic aspects and governance

c) Ecology and forests

d) Research methodologies and tools

e) Monarch butterfly and its habitat

f) Climatic and hydrological phenomena

The cloud titled "Threats, Conservation and Environmental Management" (Figure 6, subsection a) reveals the challenges and strategies implemented to protect the MBBR. It is observed that "Climate Change," "Deforestation" and "Illegal Logging" are the main challenges faced by the MBBR, suggesting that most of the research revolves around how these threats impact the ecosystem and the survival of the monarch butterfly. The appearance of "Soil degradation" is linked to deforestation and climate change, as these processes erode soil productivity and resilience. In contrast, the presence of words such as "Conservation," "Protected natural areas," and "Protection" shows that the main objective of the research is, in fact, the preservation of the area. This indicates an active search for solutions, including legal and governance frameworks (e.g., "Conservation policies" and "Environmental policy"), management mechanisms (e.g., "Monitoring," "Forest monitoring," and "Green security"), and economic mechanisms (e.g., "Payment for environmental services," "Common resources," "Subsidies," and "Sowing Life"). This word cloud highlights the duality between the pressures faced by the MBBR and efforts to mitigate their impacts.

The cloud for "Socioeconomic Aspects and Governance" (Figure 6, section b) mainly shows the structures that influence the management of the MBBR, demonstrating that conservation is not only an ecological issue, but also a social and political challenge. "Local communities" are central to this cloud, highlighting their key role. The prominent presence of "Local communities" and "Community Forest management" indicates that the management and conservation of the MBBR cannot be understood without considering the active participation of the area's inhabitants. "Organizational culture," "Community institutions" and "Ejidos" reinforce the above, indicating that the research focuses on how these communities are structured, make decisions and manage their resources. The indigenous group "Mazahua" is specifically and relevantly mentioned; highlighting that in addition to local communities in general, recognition is given to the importance of the worldview and practices of the indigenous peoples who inhabit or influence the MBBR. Words such as "public policy" and "public policy networks" are terms that reveal an interest in policy formulation and implementation processes. The term "networks" suggests that governance involves multiple actors (government, civil society, academia). The presence of the words "Conflicts" and "Tensions" reveals that the coexistence of conservation, local development and economic activities generates friction. Research on this topic probably addresses the causes, dynamics and possible solutions to these conflicts. The terms "forestry company" and "forestry exploitation" indicate that economic activity linked to forest resources is part of the analysis, possibly exploring sustainable models or the impacts of exploitation. Words such as "Tourism" and "Ecotourism," along with "Tourism operation" (1), highlight the economic importance of this activity for the region, although it is noted that this approach has not been studied much. The words "Competitiveness" and "Competitive advantages" suggest that the economic potential of the region is being analyzed and how it can position itself in sustainable markets (e.g., ecotourism, certified forest products). Finally, the concepts of "amenity value," "critical amenity value," and "forest value" are interesting because they suggest that the research not only values the economic aspects, but also the non-monetary benefits of nature and the forest (scenic beauty, recreation, quality of life).

The "Ecology and Forests" word cloud (Figure 6, section c) shows the most researched natural components and forest processes focused on characterizing the RBMM ecosystem. It is observed that "Abies religiose", the oyamel species essential for the butterfly's overwintering, predominates in the cloud, highlighting its ecological importance. The presence of terms such as "Coniferous Forest" and "Temperate Forest" refer to the type of ecosystem that predominates in the region. This suggests a sound research base. The presence of "Dendrochronology," "Radial Growth" and "Growth Rings" suggests an interest in studying tree growth and reconstructing the environmental history of forests. These methodologies help us to understand how trees respond to climatic factors and disturbances over time. Terms such as "Forest recovery," "Forest disturbance," "Forest cover loss" and "Ecological restoration" indicate that researchers are analyzing the processes of forest degradation and regeneration, which could help evaluate the effectiveness of conservation measures and plan future actions. The appearance of terms such as "Pests," "Forest pests," "Pseudohylesinus spp." and "Scolytus mundus Wood" indicates that biotic threats (such as insect outbreaks) are relevant, though perhaps less predominant than the topics of deforestation or climate change. The inclusion of "Crop Health" and "Disturbance Regime" suggests research on forest health management and natural events that impact the forest (e.g., fires, windstorms). Terms like "Biomass" and "Stem Biomass" indicate studies on the accumulation of organic matter and carbon in trees. Finally, “Saplings” and “Tree Planting Design” demonstrate an interest in natural and artificial forest regeneration.

The fourth cloud, “Research Methodology and Tools” (Figure 6, section d), groups the techniques and methods used in the studies, thus providing an overview of how research is approached in this area. The high presence of the terms “Spatial Analysis,” “Geostatistics” (2), and “Kriging” (a specific geostatistical technique) indicates a strong emphasis on understanding phenomena geographically, which is logical for a protected area, where the location and distribution of elements (forests, butterflies, deforestation) are essential. The presence of terms such as “GIS” (Geographic Information Systems), “Aerial Photography,” “Infrared Imagery,” “Small Format High-Resolution Imagery” and “SPOT” (a type of satellite that provides high-resolution images) demonstrates the use of remote sensing. This allows for monitoring of large areas, detecting changes in vegetation cover and deforestation, and assessing habitat over time. The high repetition of “Dendrochronology” indicates that tree rings have been frequently studied in the MBBR. This technique is essential for reconstructing climate stories, forest disturbances, and growth patterns over decades or centuries. It is complemented by “Dendroclimatology” (the use of tree rings to study climate) and “Dendrogeomorphology” (the use of tree rings to study geomorphological processes such as landslides), which demonstrates specific and advanced applications of this methodology. The inclusion of “Time Series” as a more general methodological concept reinforces the importance of analyzing data collected over time to identify trends, patterns and causal relationships in various phenomena. The presence of “Matrix Modeling,” “Generalized Linear Mixed Models” and “Mixed Models” suggests the use of advanced statistics to understand complex relationships between variables, predict behaviors or simulate scenarios.

The cloud titled “Monarch Butterfly and its Habitat” (Figure 6 section e) highlights the main areas of study directly related to the species, emphasizing the biology of the species and the management of its winter aggregation sites. The words “Winter Sites” and “Winter Habitat” reflect the focus of research on sites that are critical to the monarch butterfly’s winter survival; this may include research on the microclimatic conditions required, the quality of the forest at those sites and the factors that influence the success of overwintering. Terms such as “Migration” and “Migration Assistance” suggest an interest in understanding and supporting the complex movement patterns of the monarch butterfly. The words “Host,” “Haustoria,” and “Parasitic Plant” directly point to the monarch butterfly's relationship with the plants it feeds on. The term “host” refers to the milkweed plant (Asclepias), which is essential for caterpillars. “Haustoria” and “Parasitic Plant” could relate to studies on specific trophic links or less common interactions that affect the butterfly´s health or development or key plants in its habitat. The word “Nectar” reinforces the importance of food sources for adult butterflies during their journey and at overwintering sites. The word “Wing Length” could indicate morphometric studies, which are useful for assessing population health, identifying subpopulations or even relating physical characteristics to migratory success. This cloud is very specific in understanding not only where and how the monarch hibernates, but also the ecological networks that support it and the interventions to ensure the continuity of its life cycle.

The “Climatic and Hydrological Phenomena” cloud (Figure 6, section f) focuses on environmental variables that impact the ecosystem, confirming the importance of atmospheric and water conditions in the Reserve's dynamics. The high presence of “Precipitation” and “Temperature” indicates that these are the most studied climate variables. This is consistent, as both factors are critical for forest growth, nectar availability for butterflies and overwintering conditions. “Climate variability” and “Climate-related factors” suggest that research is not only focused on average climate conditions, but also on how these fluctuate over time (droughts, heat/cold waves, erratic rainfall patterns). Finally, although less frequently, the inclusion of “Flows”, “Water balance”, “Watershed management” and “Riparian systems” demonstrates that hydrology is an important component of research, primarily to understand water availability in the ecosystem.

The six keyword clusters show that research on the MBBR is organized around three cross-cutting themes: (i) ecological threats and conservation processes; (ii) the interaction between local communities, governance and economics; and (iii) the biophysical analysis of forests and climate supported by advanced methodologies. This overview confirms that the study of the MBBR has moved from traditional biological approaches to interdisciplinary perspectives, where ecology, social sciences and monitoring technologies converge. It also reveals underrepresented areas, such as sustainable tourism and cultural services, that constitute strategic opportunities for future research.

4. DISCUSSION

The findings confirm the growing relevance of the MBBR as a subject of scientific study, reflected in the number of publications over time. In line with what Pérez-Romero et al. (2025) observed, the geographic distribution of publications reflects a strong regional interest. Mexico leads the ranking of countries with the highest number of publications, and the National Autonomous University of Mexico (UNAM) is the leading educational institution. This pattern can be explained, as Pérez-Romero et al. (2025) also pointed out, by the region's commitment to the conservation of the Biosphere Reserve and the impact of research initiatives supported by the government or international cooperation agencies.

Beyond this national leading role, the analysis of productivity and citations reveals that the MBBR is also the focus of international attention, with significant contributions from the United States and Canada, key countries in the monarch butterfly migratory route. This finding highlights the need for transnational research that integrates the entire migratory cycle, in line with the proposals made by Flockhart et al. (2015) and Vidal et al. (2014). However, a more detailed interpretation of these findings indicates that ecological studies tend to dominate the thematic landscape, while social and governance-oriented research, although growing, remains comparatively less influential. This imbalance shapes the observable trends, as ecological approaches drive most citation dynamics and collaborative networks, whereas social and governance studies contribute primarily to localized or community-based perspectives. This asymmetry not only reflects differences in methodological traditions and funding priorities, but also influences how conservation problems are framed, often privileging biophysical indicators over socio-institutional dimensions. Consequently, the prevailing ecological emphasis may shape both research agendas and policy narratives, reinforcing a technically oriented understanding of conservation that does not always fully integrate community governance, local livelihoods, or multilevel institutional coordination.

Regarding productivity by author, a pattern characteristic of emerging fields is observed: a small core of highly productive researchers accounts for a large proportion of publications and citations, while the majority of authors are occasional authors. This phenomenon, previously described by Price (1963), reinforces the idea that the continuity and robustness of knowledge regarding MBBR depends largely on a relatively small group of specialists, particularly those linked to UNAM, the Michoacana University of San Nicolás de Hidalgo and WWF Mexico. This concentration may ensure the accumulation of experience, but also poses the risk of a poorly diversified research agenda. Additionally, the international collaboration patterns observed, particularly with institutions in the United States and Canada, suggest that existing partnerships focus primarily on ecological monitoring and migration biology. While these connections strengthen the continental perspective, they may still be insufficient to address governance challenges or socio-ecological integration across the entire migratory route, thereby limiting a more holistic management framework. From a practical standpoint, this means that current collaborative structures facilitate data sharing on migration dynamics and forest conditions, but may not yet provide equally robust platforms for coordinating policy instruments, harmonizing conservation incentives, or integrating community-based management strategies across national boundaries. Strengthening trinational research networks with an explicit socio-ecological orientation could therefore enhance the operational coherence of conservation actions throughout the migratory cycle.

The results for journals show that the majority of production is concentrated in national publications, primarily in Madera y Bosques, Revista Chapingo and Investigaciones Geográficas. Although this ensures local relevance and access for the Mexican academic community, it limits the international visibility of the studies. The emerging presence of articles in Q1 and Q2 journals such as Forests and Journal of Maps represents a strategic opportunity to increase the global projection of the scientific results generated around the MBBR.

Keyword analysis confirms the interdisciplinary nature of the field. The most frequent topics revolve around ecological threats (deforestation, climate change), forest conservation and restoration, community governance and monitoring methodologies based on GIS and remote sensing. This thematic diversity shows that research has moved beyond purely biological approaches to incorporate social and technological dimensions. However, the analysis also reveals gaps: sustainable tourism, cultural ecosystem services and social perception remain underexplored areas, despite their relevance to the comprehensive management of the reserve. Addressing these gaps would contribute to a more integrative research agenda capable of linking ecological resilience with social legitimacy and long-term economic sustainability.

In summary, the results suggest that research on the MBBR is in a consolidation phase: there is solid literature of publications focused on forest ecology and biological conservation, accompanied by expanding social and governance studies. To progress towards a more balanced and globally influential field, it will be key to foster the internationalization of publications, diversify the research agenda towards emerging socioeconomic topics and promote transnational collaborations that integrate the full migration cycle of the monarch butterfly. Furthermore, these findings provide relevant insights for the reserve managers and public policymakers, highlighting both the existing scientific strengths and the areas where greater research investment is needed.

It is also important to explicitly acknowledge that the reliance on WoS and Scopus introduces a potential thematic, geographic and linguistic bias, as these databases tend to privilege English-language journals, Western institutions, and fields with higher publication standardization. This limitation may underrepresent community-based studies, locally published research and emerging interdisciplinary approaches. In particular, relevant gray literature, policy reports, and Spanish-language regional journals may not be fully captured, potentially leading to an underestimation of locally grounded governance initiatives and applied conservation experiences. In addition, future studies could integrate complementary data sources to better capture emerging research fronts and non-indexed regional contributions, as well as qualitative assessments that allow for a deeper understanding of the epistemic diversity shaping the field.

5. CONCLUSIONS

The bibliometric analysis provided a systematic overview of the state of knowledge regarding the Monarch Butterfly Biosphere Reserve (MBBR), highlighting its consolidation as an emerging and multidisciplinary field of research. The results show a sustained increase in scientific production, with a strong concentration in Mexico and the active participation of national universities such as UNAM. This is not to mention the growing international collaboration that positions the MBBR as a benchmark of global interest.

Identifying the most influential authors, institutions and journals provides a clear map of key academic actors, as well as the main channels for scientific dissemination. This information constitutes a strategic tool to guide researchers and decision-makers in defining conservation partnerships, projects and policies, providing an informed basis for formulating new research questions, fostering collaborations and optimizing scientific dissemination strategies.

A relevant contribution of this study is the thematic classification of the literature through keyword analysis, which made it possible to identify both the most consolidated areas (conservation, forest ecology, climate change, community governance) and research gaps. These gaps include: the effects of climate variability on the phenology and physiology of the monarch butterfly, in-depth socio-anthropological analysis of conflicts over resource use, the poorly studied biodiversity of the MBBR (herpetofauna, birds, pollinating insects) and the integration of climatic, hydrological and socioeconomic studies to assess risks and opportunities in the region. The interconnection of these dimensions reinforces the complex nature of the MBBR, which is not only a crucial habitat for an emblematic species, but also a territory of cultural and tourist value.

Although this study provides a comprehensive overview, it is important to acknowledge certain limitations. The reliance on Scopus and WoS databases, which are among the most relevant and widely recognized international databases, means that literature not indexed on these platforms was not included, potentially underestimating the total production at the local or regional level. This reliance may introduce a selection bias, as these databases tend to prioritize journals published in English and those with greater international visibility, thereby potentially underrepresenting research published in local journals or in other languages. The search criteria used, being very specific, may have excluded relevant articles that employed more general terminology. Additionally, the analysis did not differentiate between the quality and methodological rigor of the included studies, an aspect that future work could incorporate to strengthen the interpretative depth of the findings. These limitations open the door to complementary research that includes regional repositories, alternative databases, such as Google Scholar or regional indexing systems, and comparative methodologies.

Future lines of research could include expanding the search to other databases and institutional repositories, a more in-depth analysis of international collaboration or a study of the impact of this research on Monarch Butterfly conservation policies. Furthermore, keyword analysis revealed the most studied research topics in the MBBR, while also identifying underexplored areas that represent future lines of research:

- How changes in temperature and precipitation patterns will directly affect butterfly phenology (breeding period, milkweed and nectar blooming), butterfly physiology (e.g., lipid mass for migration) and the long-term viability of overwintering sites or the need for new overwintering areas are scarce, which could contribute to defining specific and effective actions for monarch butterfly migration assistance.

- More qualitative and socio-anthropological research is needed on the deep roots of conflicts over land and resource use. This should include studies on the actual effectiveness of local governance models, the inclusion of all stakeholders, and the population's perception of the MBBR and policies.

- More extensive monitoring and studies of the Reserve's biodiversity in general are needed, not just of Oyamels and monarch butterflies. This includes herpetofauna, birds and other pollinating insects, soil microfauna and ecosystem interactions.

- More comprehensive studies are needed to model how climatic and hydrological changes (e.g., severe droughts or torrential rains) directly impact the community's livelihoods (agriculture, forestry), the risk of fires and pests and the viability of ecotourism.

- Finally, it is important to address persistent conservation challenges through sustainable management and the integration of scientific knowledge with local practices, which is essential for the long-term protection of the site.

This analysis confirms that the MBBR constitutes a strategic space not only for biological conservation, but also for interdisciplinary research, where ecological, climatic, social, economic and cultural dimensions converge. In this regard, moving towards integrated approaches that combine scientific production with public policies and local practices will be essential to ensure the long-term protection of this natural heritage. In particular, future research and management strategies should advance toward a genuinely socio-ecological and trinational framework that articulates ecological monitoring, community governance, and coordinated policy instruments across Mexico, the United States and Canada, thereby aligning scientific knowledge with the full migratory cycle of the monarch butterfly. In addition, incorporating mechanisms to periodically update the bibliometric evaluation would allow tracking emerging themes and detecting shifts in research priorities, enhancing the usefulness of this type of analysis for decision-makers.

REFERENCES

Alonso-Mejía, A., Rendón-Salinas, E., Montesinos-Patiño, E., & Brower, L. P. (1997). Use of lipid reserves by monarch butterflies overwintering in Mexico: Implications for conservation. *Ecological Applications, 7*(3), 934–947. https://doi.org/10.2307/2269444

Álvarez-García, J., Durán-Sánchez, A., & Del Río-Rama, M. (2018). Scientific coverage in community-based tourism: Sustainable tourism and strategy for social development. *Sustainability, 10*(4), 1158. https://doi.org/10.3390/su10041158

Bojórquez-Tapia, L. A., Brower, L. P., Castilleja, G., Sánchez-Colón, S., Hernández, M., Calvert, W., Díaz, S., Gómez-Priego, P., Alcántar, G., Melgarejo, E. D., Solares, M. J., Gutiérrez, L., & Juárez, M. del L. (2003). Mapping expert knowledge: Redesigning the Monarch Butterfly Biosphere Reserve. *Conservation Biology, 17*(2), 367–379. https://doi.org/10.1046/j.1523-1739.2003.01309.x

Brenner, L. (2006). Áreas naturales protegidas y ecoturismo: El caso de la Reserva de la Biosfera Mariposa Monarca, México. *Relaciones. Estudios de historia y sociedad, 28*(105).

Brenner, L. (2009). Aceptación de políticas de conservación ambiental: El caso de la Reserva de la Biosfera Mariposa Monarca. *Economía, Sociedad y Territorio.* https://doi.org/10.22136/est002009175

Castañeda, M. C., & Espinoza, E. C. (2021). Sites with charm of Morelia, Michoacán, México: Sanctuary of the Monarch Butterflies. *Journal of Tourism and Heritage Research, 4*(4), 35–45.

Catalan, A. K. R. (2015). The Monarch Butterfly Biosphere Reserve: An exemplary participative approach? *Environmental Development, 16*, 90–103. https://doi.org/10.1016/j.envdev.2015.04.005

Champo-Jiménez, O., Valderrama-Landeros, L., & España-Boquera, M. L. (2012). Forest cover loss in the Monarch Butterfly Biosphere Reserve, Michoacán, Mexico (2006–2010). *Revista Chapingo Serie Ciencias Forestales y del Ambiente, 18*(2), 143–157. https://doi.org/10.5154/r.rchscfa.2010.09.074

Commission for Environmental Cooperation. (2017). *Monitoreo de la mariposa monarca y su hábitat en América del Norte: Protocolos de monitoreo e inventariado, así como estándares de datos, para la conservación de la especie.* CEC: Montreal, Canada. https://www.cec.org/files/documents/publications/11763-monitoring-monarch-butterflies-and-their-habitat-across-north-america-inventory-es.pdf

Costas, R., Moreno, L., & Bordons, M. (2008). Solapamiento y singularidad de MEDLINE, WoS e IME para el análisis de la actividad científica en una región de Ciencias de la Salud. *Revista Española de Documentación Científica, 31*(3), 327–343.

Crane, D. (1977). *Social structure in a group of scientists: A test of the "invisible college" hypothesis.* In M. Leinhardt (Ed.), *Social structure in a group of scientists* (pp. 161–178). Academic Press.

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. *Journal of Business Research, 133*, 285–296.

Durán-Sánchez, A., Álvarez-García, J., Del Río-Rama, M. C., & Maldonado-Erazo, C. P. (2016). Economía colaborativa: Análisis de la producción científica en revistas académicas. *Revista de Gestão e Secretariado, 7*(3), 1–20.

Durán-Sánchez, A., Del Río-Rama, M. C., & Álvarez-García, J. (2017). Bibliometric analysis of publications on wine tourism in the databases Scopus and WoS. *European Research on Management and Business Economics, 23*(1), 8–15.

Esquivel, S., Cruz, G., Cadena, C., & Zizumbo, L. (2014). El turismo como instrumento de política ambiental en el Santuario de la Mariposa Monarca El Rosario. *Economía, Sociedad y Territorio, 14*(44), 141–174. El Colegio Mexiquense, A.C.

Flockhart, D. T. T., Pichancourt, J., Norris, D. R., & Martin, T. G. (2015). Unravelling the annual cycle in a migratory animal: Breeding-season habitat loss drives population declines of monarch butterflies. *Journal of Animal Ecology, 84*(1), 155–165. https://doi.org/10.1111/1365-2656.12253

Flores-Martínez, J. J., Martínez-Pacheco, A., Rendón-Salinas, E., Rickards, J., Sarkar, S., & Sánchez-Cordero, V. (2019). Recent forest cover loss in the core zones of the Monarch Butterfly Biosphere Reserve in Mexico. *Frontiers in Environmental Science, 7*, 167. https://doi.org/10.3389/fenvs.2019.00167

Gluck, M. (1990). A review of journal coverage overlaps with an extension to the definition of overlap. *Journal of the American Society for Information Science, 41*(1), 43–60.

Godínez, L., Figueroa, E., Mendoza, M. M., & Pérez-Soto, F. (2018). Análisis del ingreso mensual de las familias en El Rosario, Michoacán. In *Crecimiento y desarrollo sustentable en México.* Asociación Mexicana de Investigación Interdisciplinaria A.C.

Honey-Rosés, J., López-García, J., Rendón-Salinas, E., Peralta-Higuera, A., & Galindo-Leal, C. (2009). To pay or not to pay? Monitoring performance and enforcing conditionality when paying for forest conservation in Mexico. *Environmental Conservation, 36*(2), 120–128. https://doi.org/10.1017/S0376892909990063

Ibarra García, M. V. (2011). Conformación del espacio social de los bosques del ejido del Rosario, Michoacán, 1938–2010. *Investigaciones Geográficas, Boletín del Instituto de Geografía, UNAM, 75*, 75–87.

Kratzer, A. (2018). Biosphere reserves research: A bibliometric analysis. *eco.mont, 10*, 36–49.

Li, C., Li, Y., Wu, J., & Ma, Z. (2025). Trends in the application of citizen science in waterbird conservation: A bibliometric analysis. *Animals, 15*(3), 368.

López-García, J., & Alcántara-Ayala, I. (2012). Land-use change and hillslope instability in the Monarch Butterfly Biosphere Reserve, central Mexico. *Land Degradation & Development, 23*(4), 384–397.

Martín-Martín, A., Orduna-Malea, E., Thelwall, M., & Delgado López-Cózar, E. (2018). Google Scholar, Web of Science, and Scopus: A systematic comparison of citations in 252 subject categories. *Journal of Informetrics, 12*(4), 1160–1177.

Martínez, F., & Chávez, M. P. (2022). La Reserva de la Biosfera Mariposa Monarca, un importante espacio para el desarrollo de actividades sustentables. ATMEX. Retrieved June 10, 2025, from https://atmex.org/la-reserva-de-la-biosfera-mariposa-monarca-un-importante-espacio-para-el-desarrollo-de-actividades-sustentables/

Martínez-Vega, J., & Rodríguez-Rodríguez, D. (2022). Protected area effectiveness in the scientific literature: A decade-long bibliometric analysis. *Land, 11*, 924.

Mongeon, P., & Paul-Hus, A. (2016). The journal coverage of Web of Science and Scopus: A comparative analysis. *Scientometrics, 106*(1), 213–228.

Morante-Carballo, F., Bravo-Montero, L., Montalván-Burbano, N., & Carrión-Mero, P. (2023). Bibliometric Analysis of Earthquake Research in America: A Comparative Study Using Web of Science and Scopus Databases. *International Journal of Safety & Security Engineering*, 13(5), 966-973.

Navarrete, J.-L., Ramírez, M. I., & Pérez-Salicrup, D. R. (2011). Logging within protected areas: Spatial evaluation of the Monarch Butterfly Biosphere Reserve, Mexico. *Forest Ecology and Management, 262*(4), 646–654. https://doi.org/10.1016/j.foreco.2011.04.033

Ospino, J. O., & Yepes, G. Y. F. (2024). Effectiveness and management of terrestrial protected areas: A bibliometric analysis. *Ambiente e Água, 19*, 1–18. https://doi.org/10.4136/ambi-agua.2944

Pfeiler, E., Nazario-Yepiz, N. O., Pérez-Gálvez, F., Chávez-Mora, C. A., Laclette, M. R. L., Rendón-Salinas, E., & Markow, T. A. (2017). Population genetics of overwintering monarch butterflies (Danaus plexippus Linnaeus) from central Mexico inferred from mitochondrial DNA and microsatellite markers. *Journal of Heredity, 108*(1), 1–8. https://doi.org/10.1093/jhered/esw071

Price, D. J. de Solla. (1963). *Little science, big science.* Columbia University Press.

Pulgarín, A., & Escalona, M. A. (2007). Medida del solapamiento en tres bases de datos con información sobre ingeniería. *Anales de Documentación, 10*, 335–344.

Ramm, K., Brown, C., Arneth, A., & Rounsevell, M. (2025). Human pressure on global land ecosystems and biodiversity increases notably from 1990–2020 – Development of a spatially explicit Biodiversity Pressure Index (BPI). *EGUsphere*, preprint. https://doi.org/10.5194/egusphere-egu24-5708

Rees Catalán, A. K. (2015). The Monarch Butterfly Biosphere Reserve: An exemplary participative approach? *Environmental Development, 16*, 90–103. https://doi.org/10.1016/j.envdev.2015.04.005

Rendón-Salinas, E., Alonso, A., García-Serrano, E., Valera-Bermejo, A., & Quesada, M. (2023). The monarch butterfly in Mexico: A conservation model. *Current Opinion in Insect Science.* https://doi.org/10.1016/j.cois.2023.101112

Salouw, E., Setiawan, B., Roychansyah, M. S., & Sarwadi, A. (2024). Bibliometric analysis of tourism and community participation research: A comparison of Scopus and Web of Science databases. *International Journal of Sustainable Development and Planning, 19*(4), 1415–1422. https://doi.org/10.18280/ijsdp.190419

Samways, M. J., Pryke, J. S., Gaigher, R., & Deacon, C. (2024). Biosphere reserves in the megadiverse Cape Floristic Region are effective in conserving arthropod diversity. *Integrative Conservation, 3*(4), 312–329. https://doi.org/10.1002/inc3.72

Sáenz-Romero, C., Mendoza-Maya, E., Gómez-Pineda, E., Blanco-García, A., Endara-Agramont, A. R., Lindig-Cisneros, R., López-Upton, J., Trejo-Ramírez, O., Wehenkel, C., Cibrián-Tovar, D., Flores-López, C., Plascencia-González, A., & Vargas-Hernández, J. J. (2020). Recent evidence of Mexican temperate forest decline and the need for ex situ conservation, assisted migration, and translocation of species ensembles as adaptive management to face projected climatic change impacts in a megadiverse country. *Canadian Journal of Forest Research, 50*(9), 843–854. https://doi.org/10.1139/cjfr-2019-0329

Serrano Junco, C. L., Agudelo Idárraga, J. A., & García Donato, A. del P. (2023). Bibliometric analysis, disruptive technologies and management of educational institutions: A review of Scopus and WoS in the last five years. *Mundo FESC, 13*(27), 99–117. https://doi.org/10.61799/2216-0388.1326

Silva, S., Silva, L. F., & Vieira, A. (2023). Protected areas and nature-based tourism: A 30-year bibliometric review. *Sustainability, 15*(15), 11698. https://doi.org/10.3390/su151511698

Singh, V. (2024). Threats to biodiversity. In *Textbook of Environment and Ecology* (pp. 217–224). Springer. https://doi.org/10.1007/978-981-99-8846-4_14

Solution for Sustainable Development. (n.d). *Conservación de la Reserva de la Biosfera Mariposa Monarca, a través del desarrollo integral sostenible.* Retrieved June 10, 2025, from https://sdsnmexico.mx/banco-de-proyectos/medio-ambiente-actividades-agropecuarias-y-alimentacion/conservacion-de-la-reserva-de-la-biosfera-mariposa-monarca-a-traves-del-desarrollo-integral-sostenible/

Steven, R., & Castley, J. G. (2021). A bibliometric analysis of 44 years of research on birdwatching tourism. *Journal of Wildlife and Biodiversity, 5*(3), 10–25.

Stojanović, V., Vujičić, M., Besermenji, S., & Mijatov Ladičorbić, M. (2024). Evaluating the importance of cultural heritage in a biosphere reserve: The case of Croats (Šokci) local community in the Mura-Drava-Danube biosphere reserve (Vojvodina, Serbia). *Socijalna Ekologija, 33*(3), 257–279. https://doi.org/10.17234/socekol.33.3.7

Theobald, D. M., Oakleaf, J. R., Moncrieff, G., Voigt, M., Kiesecker, J., & Kennedy, C. M. (2025). Global extent and change in human modification of terrestrial ecosystems from 1990 to 2022. *bioRxiv,* preprint. https://doi.org/10.1101/2025.01.12.632633

Toilbay, O., Moldabekov, A., Moldabekova, N., & Abai, A. (2023). Impact of human population growth on species extinction. *Вестник КазАТК, 129*(6), 432–439. https://doi.org/10.52167/1609-1817-2023-129-6-432-439

UNESCO. (2025a). ¿Qué son las reservas de la biosfera? Retrieved June 10, 2025, from https://www.unesco.org/es/mab/wnbr/about

UNESCO. (2025b). *Lista del Patrimonio Mundial.* Retrieved June 10, 2025, from https://whc.unesco.org/es/list/

van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics, 84*(2), 523–538.

Vicente, J. C. (2020). *Monitoreo de restauración activa y pasiva en un sitio perturbado dentro de la zona núcleo de la Reserva de la Biosfera Mariposa Monarca* [Master's thesis, Universidad Michoacana de San Nicolás de Hidalgo].

Vidal, O., López-García, J., & Rendón-Salinas, E. (2014). Trends in deforestation and forest degradation after a decade of monitoring in the Monarch Butterfly Biosphere Reserve in Mexico. *Conservation Biology, 28*(1), 177–186. https://doi.org/10.1111/cobi.12138

Vidal, O., & Rendón-Salinas, E. (2014). Dynamics and trends of overwintering colonies of the monarch butterfly in Mexico. *Biological Conservation, 180*, 165–175. https://doi.org/10.1016/j.biocon.2014.09.041

Xu, B. (2022). Monarch butterfly conservation (Mexico). *Oxford Research Encyclopedia of Latin American History.* https://doi.org/10.1093/acrefore/9780199366439.013.1084

Zhu, J., & Liu, W. (2020). A tale of two databases: The use of Web of Science and Scopus in academic papers. *Scientometrics, 123*(1), 321–335. https://doi.org/10.1007/s11192-020-03387-8

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Convergencia Relativa del Índice de Libertad Económica en Canadá

Relative Convergence of the Index of Economic Freedom in Canada

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Resumen

Este trabajo analiza la hipótesis de convergencia relativa del índice de libertad económica a nivel provincial en Canadá durante el período 1981-2021. Para ello, se emplea la metodología propuesta por Phillips y Sul (2007, 2009), que permite evaluar la convergencia considerando tanto la heterogeneidad idiosincrásica como común de las variables a lo largo del tiempo mediante un modelo de factor de transición no lineal. Esta aproximación no requiere supuestos sobre las propiedades estocásticas o de cointegración de la variable, lo que la hace especialmente adecuada para estudios de convergencia económica. Los resultados muestran que la mayoría de las provincias forman un gran club convergente, mientras que Quebec sigue una trayectoria divergente. Este hallazgo indica la presencia de múltiples estados estacionarios en la libertad económica regional y subraya la relevancia de factores estructurales e institucionales en la dinámica de convergencia. La identificación de un grupo no convergente tiene importantes implicaciones para la formulación de políticas públicas, orientadas a armonizar la calidad institucional y promover un crecimiento económico equilibrado en todo el país.

Palabras clave: Clubes de Convergencia, Libertad Económica, Modelos de Series de Tiempo, Modelos Panel.

Códigos JEL: O47, O43, C23, C22, R11, O18

Abstract

This paper analyses the hypothesis of relative convergence of the index of economic freedom at the provincial level in Canada during the period 1981–2021. To this end, it employs the methodology proposed by Phillips and Sul (2007, 2009), which allows for the evaluation of convergence by considering both the idiosyncratic and common heterogeneity of variables over time through a nonlinear transition factor model. This approach does not require assumptions about the stochastic or cointegration properties of the variable, making it particularly suitable for studies of economic convergence. The results show that most provinces form a large convergent group, while Quebec follows a divergent trajectory. This finding indicates the presence of multiple stationary states in regional economic freedom and underscores the relevance of structural and institutional factors in the dynamics of convergence. The identification of a non-convergent group has important implications for the formulation of public policies aimed at harmonizing institutional quality and promoting balanced economic growth across the country.

Keywords: Convergence Clubs, Economic Freedom, Time Series Models, Panel Models.

JEL Codes: O47, O43, C23, C22, R11, O18

1. INTRODUCCIÓN

La libertad económica es considerada como una medida de calidad institucional y un componente clave para fomentar el crecimiento económico. Diferentes estudios han abordado su impacto en la inversión, el desarrollo humano y la estabilidad económica (Hall y Lawson, 2014; Lawson et al., 2020; Gwartney et al., 1999). La Fundación Heritage (2013) concibe la libertad económica como la condición en la que los individuos pueden actuar con autonomía mientras están en la búsqueda de su sustento económico y prosperidad (Chang et al., 2015). De manera similar, Patsoulis y Demetriou (2024) sostienen que la libertad económica se refiere al grado en que los individuos y las empresas pueden tomar decisiones económicas sin la intervención gubernamental o las restricciones que el gobierno puede imponer.

En particular, este estudio se centra en la convergencia de la libertad económica a nivel subnacional en Canadá, una brecha poco explorada en la literatura, y aplica la metodología de Phillips y Sul (2007, 2009) para identificar posibles clubes de convergencia, lo que permite captar dinámicas diferenciadas entre provincias que no serían evidentes con métodos tradicionales.

Desde los años noventa, la cuantificación de la libertad económica ha permitido analizar cómo las políticas e instituciones afectan el desempeño económico (Villarroya y Escosura, 2006). Tanto la Fundación Heritage como el Instituto Fraser construyen índices objetivos que reflejan la coherencia institucional y permiten evaluar diferencias a nivel regional o nacional. El Índice de Libertad Económica Mundial (EFW) captura cambios en factores como educación, gobierno estable y derechos de propiedad, mejorando el análisis de su relación con el crecimiento económico (Hall et al., 2019).

El índice de libertad económica proporciona una medida para evaluar "la consistencia de las políticas e instituciones de una nación con la libertad económica" (Hall, Lacombe y Shaughnessy, 2019). Aunque los economistas clásicos reconocían la importancia de la educación, un gobierno estable y los derechos de propiedad en el crecimiento económico, no podían medirlas y las consideraban constantes. Sin embargo, el Índice de Libertad Económica Mundial (EFW) permite capturar cambios en estas variables y mejorar la precisión de los análisis sobre su relación con el crecimiento económico (Hall et al., 2019).

En años recientes, el estudio de la convergencia en los índices de libertad económica ha cobrado mayor interés, inspirado en los trabajos pioneros sobre convergencia del ingreso realizados por Baumol (1986) y Barro y Sala-i-Martin (1991, 1992). El análisis de convergencia en la libertad económica resulta fundamental, ya que permite evaluar si las provincias con menor libertad económica inicial tienden a reducir su brecha con aquellas que presentan mayores niveles. Comprender esta dinámica es crucial para analizar la evolución de la calidad institucional y el crecimiento económico en distintas regiones. Además, conocer los factores que determinan la convergencia o divergencia en los niveles de libertad económica puede ser clave para el diseño de políticas públicas efectivas a nivel regional.

La libertad económica no solo contribuye al crecimiento económico, sino que también puede influir en la convergencia de ingresos (Hall y Lawson, 2014; Lawson et al., 2020, y Lawson, 2022). En este contexto, algunos estudios han encontrado que un mayor grado de libertad económica suele estar positivamente correlacionado con variables como la inversión, la estabilidad financiera y el respeto a los derechos humanos (Payne et al., 2023). La comprensión del comportamiento de la convergencia económica puede arrojar luz sobre la persistencia observada en las diferencias de ingresos entre los estados. Hall y Lawson (2014) reportan que el índice de libertad económica se utiliza en cientos de artículos académicos. Excluyeron estudios con un uso menor de este índice (174 de 392). La mayoría de los artículos restantes (67%) encontraron que las variables independientes del índice se correlacionan de manera positiva con las variables dependientes, como el crecimiento, la inversión, la paz, los derechos humanos, entre otros. Estos resultados indican que el índice de libertad económica y, por extensión, la libertad económica, los derechos humanos, los derechos de propiedad y variables de control similares afectan los resultados económicos. Por lo tanto, es importante determinar si los valores del índice de libertad económica convergen o divergen, ya que, si este índice converge y mejora los resultados económicos, agregaría credibilidad a la afirmación del modelo de crecimiento neoclásico de que las economías convergen a medida que crecen. Sin embargo, otros estudios advierten que el aumento de la libertad económica también podría generar efectos adversos en términos de desigualdad de ingresos y distribución de la riqueza (Carter, 2007; Bergh y Nilsson, 2010; Apergis y Cooray, 2017).

En el contexto de la libertad económica, la noción de convergencia implica que los países o regiones con niveles iniciales más bajos de libertad económica alcanzan a los países o regiones con niveles iniciales más altos en su camino hacia un estado estable o estacionario (Payne et al., 2023). Este proceso de convergencia puede estar impulsado por la competencia institucional, ya que los factores de producción tienden a ubicarse en regiones con una mejor calidad institucional, obligando a los demás territorios a adaptarse para mantenerse competitivos.

A pesar de la creciente literatura sobre la convergencia económica, los estudios sobre la convergencia de la libertad económica a nivel subnacional son escasos. Mientras que la mayoría de los trabajos se han centrado en comparaciones entre países, existe una brecha en la investigación sobre la convergencia en libertad económica dentro de un mismo país. Este estudio busca llenar ese vacío analizando si las provincias de Canadá convergen en términos de libertad económica y, en caso contrario, identificar posibles clubes de convergencia. En particular, no existen estudios que analicen de manera sistemática la convergencia relativa del índice de libertad económica entre provincias canadienses en un periodo largo (1981-2021), considerando la heterogeneidad estructural entre unidades subnacionales y la posible formación de clubes de convergencia.

Por lo tanto, la contribución principal de este trabajo es doble: primero, extender el análisis de convergencia de libertad económica al nivel subnacional en Canadá, utilizando un periodo de cuatro décadas; y segundo, aplicar la metodología de Phillips y Sul (2007, 2009) para identificar clubes de convergencia, lo que permite captar dinámicas diferenciadas que no serían evidentes mediante pruebas tradicionales de convergencia o métodos a nivel nacional.

En este contexto, este trabajo plantea la siguiente pregunta de investigación: ¿existe convergencia en el índice de libertad económica entre las provincias canadienses en el periodo 1981-2021? Para responderla, se emplea la metodología de Phillips y Sul (2007, 2009), que permite evaluar la convergencia en presencia de heterogeneidad estructural y clasificar a las provincias en distintos grupos según sus trayectorias de convergencia.

El trabajo se encuentra estructurado de la siguiente manera: en la siguiente sección se discute la literatura existente sobre la convergencia de la libertad económica y su relación con el crecimiento económico. Posteriormente, se describe la metodología empleada y se presentan los datos utilizados.

En la sección de resultados, se exponen los hallazgos del análisis empírico. Finalmente, en las conclusiones se sintetizan los principales resultados de la investigación y se sugieren futuras líneas de investigación.

2. REVISIÓN DE LA LITERATURA EMPÍRICA

La literatura sobre la convergencia de la libertad económica ha estado históricamente enfocada en comparaciones entre países, con escasos estudios sobre su evolución dentro de una misma nación. Algunos trabajos recientes han explorado la convergencia de la libertad económica en niveles subnacionales, pero siguen siendo excepcionales. A excepción de los trabajos de Naghshpour y Nissan (2018), Payne et al., (2023a) y Payne et al. (2023b) realizaron estudios para los Estados Unidos, la convergencia de la libertad económica al interior de los países ha sido poco investigada. Este vacío en la literatura refuerza la necesidad de estudiar la dinámica de la convergencia en el contexto canadiense, donde hasta la fecha no existen análisis sistemáticos sobre la convergencia relativa del índice de libertad económica entre provincias.

Este estudio aporta evidencia original al centrarse en Canadá, utilizando un periodo largo (1981–2021) y aplicando un enfoque exclusivo en la convergencia relativa y la identificación de clubes de convergencia, algo que no ha sido abordado por estudios previos sobre EE. UU., el PIB provincial o comparaciones internacionales.

Para organizar la revisión, se presentan los estudios en tres bloques: (1) convergencia de la libertad económica a nivel internacional, (2) convergencia en Estados Unidos y (3) evidencia empírica sobre Canadá.

2.1 Convergencia de la libertad económica a nivel internacional

Sobel y Coyne (2011), a través de pruebas de raíz unitaria y cointegración analizan la hipótesis de convergencia estocástica a largo plazo entre varias medidas de calidad institucional (incluida la libertad económica) y, los cambios simultáneos en el desempeño económico a lo largo del tiempo. Sus resultados sugieren que el índice de libertad económica mundial es estacionario, lo que indica una persistencia y aumento progresivo de la libertad económica a nivel global. Sin embargo, no examinan dinámicas regionales específicas ni diferencias en el ritmo de convergencia entre países.

Elert y Halvarsson (2012) encontraron que los países con menor calidad institucional experimentan cambios institucionales más rápidos que aquellos con mayor calidad institucional, lo que respalda la idea de convergencia institucional. Esto implica que los países con instituciones menos desarrolladas tienden a ajustarse más rápidamente para alcanzar niveles similares a los países con instituciones más sólidas. Estos resultados sugieren que, aunque la convergencia es posible, no ocurre de manera uniforme en todas las regiones.

Heckelman (2015) utiliza datos del Índice de Libertad Económica de Heritage y sus 10 subcomponentes para 97 países para evaluar la σ-convergencia y encuentra que la libertad económica ha aumentado con el tiempo, aunque las disparidades en la libertad económica entre los países han crecido. Sus resultados revelan la ausencia de convergencia en el índice agregado de libertad económica y en los subcomponentes asociados a los derechos de propiedad, la libertad empresarial, la libertad de inversión y la libertad financiera. Este hallazgo refuerza la necesidad de examinar si la convergencia se da en grupos diferenciados o clubes.

Por su parte, Savoia y Sen (2016) examinan la convergencia de la calidad legal, burocrática y administrativa, junto con la calidad del entorno contractual y la aplicación de los derechos de propiedad, utilizando métodos de sección transversal y panel para respaldar la convergencia institucional. Su investigación busca comprender cómo estas dimensiones institucionales se relacionan entre sí y cómo influyen en el proceso de convergencia económica. Sus hallazgos respaldan la existencia de convergencia institucional, aunque con velocidades diferenciadas según el tipo de institución analizada. Estos hallazgos contribuyen a la comprensión de la importancia de las instituciones en el desarrollo económico.

Hall (2016) evalúa el comportamiento de convergencia de los índices de libertad económica en el periodo de 1980 a 2010 en 81 países utilizando los datos del Índice de Libertad Económica Mundial del Instituto Fraser (Fraser Institute). Su principal objetivo es analizar si los países con niveles más bajos de libertad económica convergen hacia aquellos con niveles más altos. Sus resultados muestran evidencia de β-convergencia condicional en la libertad económica, países con menores niveles de libertad convergen hacia países con mayores niveles de libertad económica, aunque a una tasa lenta. Este resultado plantea la posibilidad de que la convergencia sea más evidente en unidades con características estructurales similares, como regiones dentro de un mismo país.

Kallioras et al., (2017) investigan la convergencia de la libertad económica utilizando el índice de la Fundación Heritage (Heritage Foundation) para 19 países de la Eurozona, mostrando convergencia en el período 2001-2008, pero divergencia en la libertad económica entre 2008 y 2017. Durante el primer período, los países de la Eurozona se acercaron en términos de libertad económica, pero luego experimentaron divergencia en los años posteriores. Lo cual sugiere que otros factores, como las crisis económicas, pueden afectar la trayectoria de convergencia en la libertad económica.

2.2 Convergencia de la libertad económica en Estados Unidos

Naghshpour y Nissan (2018) analizan la convergencia del índice de libertad económica utilizando datos de los 50 estados de EE. UU. (agrupados en las ocho regiones BEA) del informe de Libertad Económica de América del Norte publicado por el Fraser Institute. A través de un análisis de varianza de dos vías y pruebas de β-convergencia absoluta durante el período 1981-2014. Sus resultados muestran evidencia mixta, con algunos estados convergiendo y otros manteniendo brechas persistentes.

Payne et al., (2023a) implementa diversas pruebas de convergencia al índice de libertad económica de 50 estados de EE.UU. Para el enfoque de convergencia estocástica emplea pruebas de raíz unitaria para procesos acotados con y sin considerar cambios estructurales, utilizando el enfoque metodológico de Cavaliere (2005), Cavaliere y Xu (2014) y Carrion-i-Silvestre y Gadea (2016). Estas pruebas les permiten analizar la estacionariedad de las series de datos que representan la libertad económica en un rango acotado. Su objetivo es determinar si existen cambios estructurales en la evolución de la libertad económica a lo largo del tiempo. Sus resultados muestran evidencia de convergencia estocástica limitada.

Payne et al., (2023a) exploran otras hipótesis de convergencia sobre el índice de libertad económica de los estados de la Unión Americana como son la convergencia relativa y la de σ-convergencia débil, con respecto a la primera encuentran evidencia de dos clubes de convergencia, mientras que en el caso de la segunda no encuentran evidencia de σ-convergencia débil. Adicionalmente, a través de la estimación de un modelo logit, proveen un análisis de los determinantes de los clubes de convergencia y encuentran que el ingreso real per cápita y el nivel inicial de libertad económica de un estado aumentan la probabilidad de pertenecer al club de convergencia con mayor libertad económica. Sin embargo, los estados con mayor fragmentación racial tienen menos posibilidades de pertenecer al club con mayor libertad económica. Los otros determinantes, como el nivel educativo, la producción per cápita de combustibles fósiles, las condenas por corrupción, la descentralización fiscal y los estados con gobernadores demócratas, no tienen una influencia estadísticamente significativa en la explicación de los clubes de convergencia.

Payne et al., (2023b) ponen a prueba la hipótesis de convergencia estocástica en los tres principales subcomponentes de la libertad económica (gasto público, fiscalidad y libertad del mercado laboral) para los 50 estados de EE. UU. en el periodo comprendido de 1981 a 2019. A través de pruebas de raíz unitaria con rupturas estructurales para procesos acotados. Sus resultados muestran evidencia limitadas a favor de la convergencia estocástica en los tres subcomponentes de la libertad económica y ponen de relieve la distinta naturaleza de la calidad institucional entre los estados, representada por el gasto público, la fiscalidad y la libertad del mercado laboral. Este estudio destaca la importancia de analizar los diferentes componentes del índice de libertad económica con la finalidad de comprender por qué se presenta o no la convergencia en este indicador.

Payne et al., (2025) investigan la convergencia de los niveles de libertad económica de todos los países en el periodo de posguerra a través de las pruebas de Phillips y Sul (2007) y encuentran que no convergen en un sólo grupo, pero si en varios clubes. Una vez identificados dichos clubes, determinan los factores que explican la pertenencia de los países a cada uno de estos clubes de convergencia. Sus resultados demuestran que los países pertenecientes a los clubes de convergencia de mayor libertad económica tienen menos probabilidades de tener un origen jurídico francés y una menor dependencia de las rentas de los recursos naturales, y más propensos a tener gobiernos democráticos y de larga duración, mayor facilidades para salir, una mayor migración neta, un mayor crecimiento económico, un mayor control sobre la corrupción, más control sobre los recursos naturales y un mayor poder adquisitivo y una población más densa y envejecida.

Estos estudios resaltan que, aunque se ha investigado la convergencia subnacional en EE. UU., no existe un análisis equivalente para Canadá sobre la libertad económica provincial, lo que constituye un vacío que este trabajo busca llenar.

2.3 Evidencia empírica sobre Canadá

Hasta la fecha, los estudios sobre la convergencia de la libertad económica en Canadá son limitados. Sin embargo, la metodología de Phillips y Sul (2007) ha sido utilizada en investigaciones sobre convergencia económica en el país. Hamit-Haggar (2013) aplicó esta prueba para analizar el PIB per cápita de las provincias canadienses entre 1981 y 2008, encontrando evidencia de tres clubes de convergencia.

Serenidou (2023) somete a prueba los enfoques sigma, beta, estocástica y relativa (clubes) del ingreso real disponible de las provincias canadienses en diversos periodos. Sus resultados muestran evidencia de sigma convergencia para este indicador en el periodo de 1926 a 2020. En tanto que la convergencia beta se produce para todo el período 1926-2020 y el subperíodo 1950-2020, pero no para los subperiodos más recientes, específicamente para los periodos 1981-2020 y 1996-2020. En cambio, las pruebas de raíz unitaria no respaldan la evidencia de convergencia estocástica, por el contrario, las pruebas de cointegración muestran evidencia de este enfoque en el periodo 1949-2020. Además, también muestran que es importante distinguir entre las medidas del ingreso personal real y el de los hogares, ya que, en algunos casos, las distintas medidas pueden llevar a conclusiones diferentes, especialmente en términos de ingreso disponible y no disponible. Por otro lado, las pruebas de Phillips y Sul (2007) revelan que las unidades no convergen en un solo grupo, sino que lo hacen en clubes, no obstante, independientemente de la variable que se analice no hay una gran dispersión en cuanto al número de provincias que conforman los clubes, debido a que sólo son dos cuando se toma como año final 1981 y hasta tres cuando el año final es 1996, y generalmente, el primer club es el que más provincias agrupa.

Nuestro análisis amplía esta evidencia al ser el primer estudio que aplica la metodología de Phillips y Sul (2007, 2009) al índice de libertad económica provincial, utilizando un periodo de 1981 a 2021. A diferencia de estudios previos sobre PIB o ingresos, este trabajo se centra exclusivamente en la convergencia de la libertad económica y la identificación de clubes de convergencia, ofreciendo así una perspectiva inédita sobre la dinámica subnacional del indicador en Canadá.

La literatura existente sugiere que la convergencia en libertad económica no es un fenómeno homogéneo y puede estar influenciada por factores estructurales e institucionales. Este estudio contribuye a la literatura al evaluar si la libertad económica en las provincias canadienses sigue una trayectoria de convergencia, proporcionando información relevante para políticas públicas y para la comprensión de la heterogeneidad institucional a nivel subnacional.

3. DATOS Y MODELO DE CONVERGENCIA RELATIVA

3.1 Prueba de convergencia y de agrupamiento en Clubes

Para estudiar la convergencia del índice de libertad económica en las provincias canadienses empleamos la prueba $\log t$ de convergencia relativa en un modelo factorial variante en el tiempo no lineal (Phillips y Sul, 2007). Este enfoque permite evaluar la convergencia sin asumir estacionariedad en las series temporales y permite la identificación de múltiples clubes de convergencia dentro del conjunto de unidades analizadas.

En comparación con otros métodos para probar convergencia, la prueba de regresión $\log t$ tiene las siguientes ventajas: (i) evita el sesgo y la inconsistencia en la estimación causados por variables omitidas y endógenas en modelos tradicionales, como el modelo de crecimiento de Solow; (ii) no requiere supuestos específicos sobre la estacionariedad de las series temporales, a diferencia de las pruebas de raíz unitaria y cointegración; y (iii) si la muestra poblacional no converge en su totalidad, permite detectar grupos homogéneos de unidades que sí lo hacen, identificando clubes de convergencia (Panopoulou y Pantelidis, 2009; Hu et al., 2015; Du, 2017) y Gao et al., 2021).

A diferencia de otras metodologías, como las pruebas de raíz unitaria (ADF, Phillips-Perron) o los modelos de cointegración de Johansen, que se han empleado para estudiar convergencia entre países o al interior de los mismos, que requieren supuestos estrictos sobre la estacionariedad de las series y pueden no capturar la heterogeneidad estructural en la convergencia de diferentes unidades, el método de Phillips y Sul permite analizar dinámicas de convergencia sin estas restricciones y es más adecuado cuando se sospecha que existen múltiples estados estacionarios o clubes de convergencia. Otra ventaja del empleo de esta metodología está relacionada con la naturaleza del índice de libertad económica que, al ser una variable acotada, entre 0 y 10, determinadas pruebas de convergencia pueden no ser las más apropiadas.

Modelo factorial no lineal

A través de un modelo simple de un solo factor, los datos de panel se pueden representar como:

$$X_{it} = b_i \mu_t + \varepsilon_{it} \qquad (1)$$

donde μ_t es el factor común y ε_{it} es el término de perturbación. El modelo factorial no lineal variante en el tiempo se obtiene incorporando el término de perturbación en el coeficiente:

$$X_{it} = \delta_{it} \mu_t \qquad (2)$$

donde $i = 1,2,\ldots,N$ y $t = 1,2,\ldots,T$. N y T son el número de unidades de sección cruzada y la longitud del periodo, respectivamente. δ_{it} es un componente variante en el tiempo no uniforme, el cual mide la distancia entre el factor común μ_t y la variable dependiente X_{it}, y que se puede descomponer en:

$$\delta_{it} = \delta_i + \frac{\sigma_i}{L(t)t^{\alpha}} \xi_{it} \qquad (3)$$

donde δ_i es fija y no cambia con el tiempo; ξ_{it} sigue la distribución normal estándar para cada i y es independiente e idénticamente distribuida, pero débilmente dependiente de t; $L(t)$ es una función que varía lentamente similar a $\log t$. Cuando $\alpha > 0$, t tiende al infinito, δ_{it} converge a δ_i.

Por lo tanto, la relación entre α y 0 puede emplearse como base de juicio para la convergencia. En el análisis empírico, se especifica el siguiente modelo (Gao et al., 2021):

Hipótesis nula $H_0 : \delta_{it} = \delta_t$ y $\alpha \geq 0$, convergencia.

Hipótesis alternativa $H_1 : \delta_{it} \neq \delta_t$ y $\alpha \leq 0$, no convergencia.

Procedimiento de la prueba $\log t$

Phillips y Sul (2007) usan los siguientes tres pasos para expandir la prueba de hipótesis:

1) Construya la razón de la varianza de la sección cruzada H_1/H_t:

$$H_t = \frac{1}{N}\sum_{i=1}^{N}\left(h_{it}-1\right)^2 ; h_{it} = \frac{X_{it}}{N^{-1}\sum_{i=1}^{N} X_{it}}$$

2) Estime la siguiente regresión, la prueba $\log t$, sobre la siguiente formula:

$$\log\left(\frac{H_1}{H_t}\right) - 2\log L\left(t\right) = b_0 + 2\alpha \log t + u_t \qquad (4)$$

donde $t = \left[rT\right], \left[rT\right]+1, \ldots, T$. Phillips y Sul (2007) establecen descartar una pequeña fracción (por ejemplo, $r = 0.3$) de los datos de la serie temporal es útil para notificar el resultado de la prueba cuando el tamaño de la muestra se incrementa. La función que varía lentamente $L(t) = \log\left(t+1\right)$ (Haider y Akram, 2019; y Tian et al., 2016), o $L(t) = \log\left(t\right)$ (Bai et al., 2019; Ulucak y Apergis, 2018); Yu et al., 2018) se utiliza comúnmente en la literatura.

3) Se utiliza una prueba t unilateral de autocorrelación y heterogeneidad (HAC) para probar la hipótesis nula. Si $t_b < -1.65$, se rechaza la hipótesis nula con un nivel de confianza del 5%.

Si la población no converge, se puede realizar el análisis de convergencia de clubes dividiendo las muestras en varios clubes de acuerdo con los siguientes pasos:

3.1) Ordenar los miembros del panel de acuerdo con los valores observados del último período (es decir, el último $1/2\ T$ o $1/3\ T$). Si hay una gran fluctuación en los datos, el ordenamiento se puede realizar de acuerdo con el promedio de los valores observados en el último período.

3.2) Formar un grupo central. Una vez llevado a cabo el ordenamiento, se realiza la prueba $\log t$ sobre las primeras $k\left(2 \leq k \leq N\right)$ muestras por turno hasta que $t_k < -1.65$, y las muestras correspondientes al t_k máximo sean miembros del grupo central.

3.3) Elegir a los miembros del club. Una vez que se determinan los miembros del grupo central, se añaden los individuos restantes al grupo central uno por vez y se realiza la regresión $\log t$. Si el estadístico t es mayor que un cierto umbral C (por ejemplo, $C = 0$), el individuo pertenece al club. Repita los pasos para seleccionar a todos los miembros del club. Luego realice la prueba $\log t$ sobre todos los miembros del club. Si $t > -1.65$, estos miembros pertenecen en realidad a un club. Si no, aumente gradualmente el umbral C de admisión al club, hasta que $t < -1.65$.

3.4) Repita los pasos anteriores para los miembros restantes hasta que se seleccionen todos los clubes. Puede haber algunos individuos divergentes que no pertenecen a ningún club.

3.5) Fusión de clubes. El tercer paso aumenta el umbral de entrada al seleccionar miembros del club $\left(C > -1.65\right)$, por lo tanto, puede haber convergencia entre grupos en el nivel de significancia del 5%. Marque los clubes originales obtenidos en los primeros cuatro pasos como club 1 a N. Realice una prueba $\log t$ en cada uno de dos clubes adyacentes y obtener el estadístico t correspondiente, $t_k\left(1 \le k \le N-1\right)$. Si $t_k > -1.65$ y $t_k > t_{k+1}$, combine los dos grupos correspondientes a t_k. Cuando $t_{N-1} > -1.65$, combine los dos últimos grupos (Schnurbus et al., 2017).

Este método es simple de operar y flexible en su aplicación, y puede usarse para distinguir varias formas posibles de convergencia y divergencia: convergencia global, divergencia global y clubes de convergencia (Gao et al.,2021).

4. DATOS Y RESULTADOS

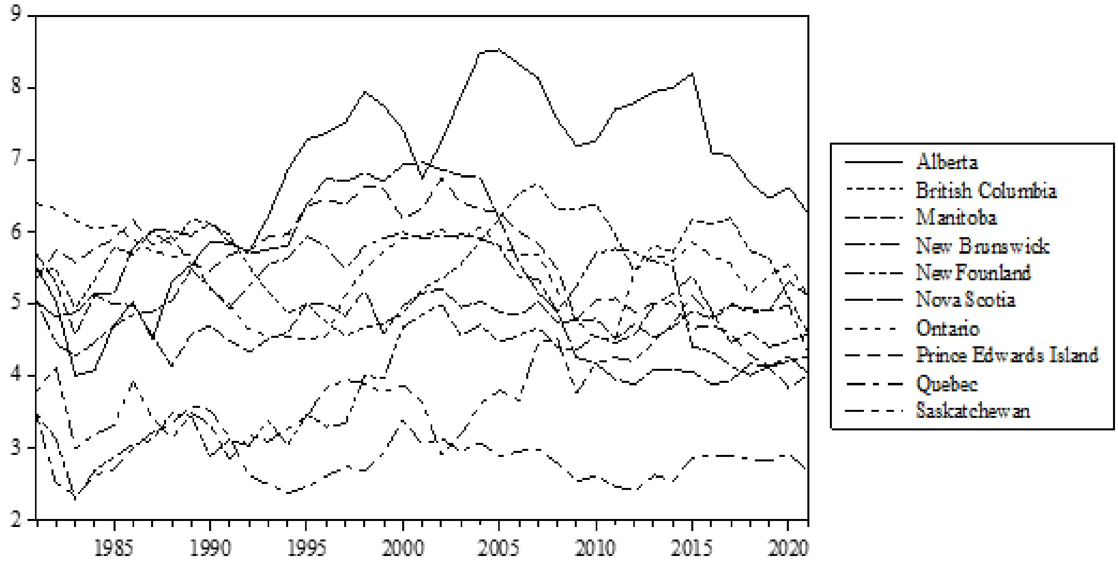
Los datos empleados en este trabajo corresponden al índice de libertad económica a nivel de provincias de Canadá para el período que va de 1981 a 2021 y provienen de la página del Instituto Fraser1 (Fraser Institute). Para el análisis, se aplicó el logaritmo natural de la variable y posteriormente se filtró mediante el filtro de Hodrick-Prescott (HP), utilizando un parámetro de suavizamiento λ= 100, adecuado para datos anuales. El uso del filtro HP se consideró necesario para extraer la componente tendencial de largo plazo del índice de libertad económica, eliminando fluctuaciones cíclicas de corto plazo que podrían enmascarar la dinámica estructural relevante para la identificación de clubes de convergencia. Dado que la metodología de Phillips y Sul se centra en trayectorias relativas de largo plazo, el uso del componente tendencial resulta coherente con el objetivo del estudio.

Si bien el índice de libertad económica es una variable acotada (0–10), el filtrado permite observar más claramente las tendencias subyacentes a largo plazo, facilitando el análisis de convergencia relativa mediante la metodología de Phillips y Sul (2007, 2009). Sin embargo, se reconoce que el filtrado podría suavizar la dinámica original de la serie y, por ende, atenuar las fluctuaciones extremas que podrían influir en la identificación de unidades divergentes o la magnitud del estadístico de convergencia. Por ello, los resultados deben interpretarse considerando que reflejan principalmente las tendencias de largo plazo en la libertad económica, más que la variabilidad puntual año a año.

La gráfica 1 muestra la evolución del índice de libertad económica de las provincias canadienses en el periodo comprendido entre 1981 y 2021. En dicha gráfica se puede apreciar que, con excepción de Quebec, el cual se mantiene constante en un nivel relativamente bajo en el periodo de estudio, la mayoría de las provincias canadienses tiende a converger en un intervalo que va de 4 a 6.5.

[1] https://www.fraserinstitute.org/studies/economic-freedom

Gráfica 1. Evolución del Índice de Libertad Económica de las Provincias Canadienses: 1981-2021



Los resultados de la prueba de convergencia relativa de Phillips y Sul (2007) para el índice de libertad económica para Canadá a nivel de provincias se presentan en el cuadro1. La estimación puntual de $\widehat{b}$ es negativa, lo que implica que se rechaza la hipótesis nula de convergencia para todas las provincias canadienses en el periodo objeto de estudio, ya que el estadístico t correspondiente a $\widehat{b}$ $\left(t_{\widehat{b}}\right)$ es menor que el que el valor crítico del 5% de -1.65.

Cuadro 1. Prueba de Clubes de Convergencia (1981 – 2021)

Prueba de Convergencia Total			
Club	$\widehat{b}$	*estadístico-t*	*Provincias*
Único	-0.2252	-13.0697	10
Pruebas de Clubes de Convergencia			
Club	$\widehat{b}$	*estadístico-t*	*Provincias*
1	0.2040	3.7042	9
Provincias que integran el *Club* 1:			
| Alberta | British Columbia | Manitoba | New Brunswick | | Newfoundland | Nova Scotia | Ontario | Prince Edward Island | | Saskatchewan |			
Grupo no Convergente			
| Quebec |			

Fuente: Elaboración propia.

El rechazo de la hipótesis nula de convergencia para la totalidad de las provincias no excluye la posibilidad de convergencia de subgrupos del panel.

El cuadro 1 muestra también los resultados de la prueba de clubes de convergencia, incluidas las pruebas de clasificación inicial de clubes. El algoritmo de agrupación identifica un gran club convergente con un estadístico t superior a -1.65 que comprende casi la totalidad de las provincias canadienses, con excepción de Quebec, que de hecho es la única provincia que conforma un grupo divergente.

De esta forma, las pruebas de convergencia relativa propuestas por Phillips y Sul (2007 y 2009) nos permiten concluir que el índice de libertad económica de las provincias de Canadá no converge en un solo grupo, pero si en un gran club convergente que agrupa 9 de las 10 provincias, mientras que Quebec permanece como una provincia no convergente.

El carácter divergente de Quebec puede estar asociado a particularidades económicas e institucionales propias de la provincia, tales como un mayor grado de intervención estatal en la actividad económica, una estructura fiscal relativamente más elevada y un marco regulatorio más estricto, en comparación con otras provincias canadienses. Asimismo, factores históricos e institucionales, como su modelo social y económico diferenciado y una mayor presencia del sector público en áreas clave, podrían contribuir a explicar la persistencia de niveles más bajos de libertad económica y su falta de convergencia con el resto del país.

Este patrón de un gran club convergente, acompañado de una unidad divergente, resulta consistente, aunque menos fragmentado, que la evidencia encontrada para Estados Unidos en estudios recientes que aplican la misma metodología. Mientras que en el caso estadounidense se identifican múltiples clubes con mayor heterogeneidad estructural, el caso canadiense parece mostrar un grado relativamente mayor de homogeneidad institucional entre provincias, con la excepción de Quebec. Esta comparación sugiere que el federalismo canadiense podría estar asociado a menores niveles de fragmentación en términos de libertad económica.

5. CONCLUSIONES

En este trabajo se ha proporcionado evidencia empírica sobre el comportamiento de la convergencia de la libertad económica a nivel de provincias en Canadá. Con la excepción de algunos trabajos que se han efectuado para Estados Unidos, la mayoría de los trabajos hasta la fecha se ha centrado exclusivamente en la convergencia de la libertad económica entre países. En este sentido, este estudio se enfoca en la dinámica interna de un país (Canadá), contribuyendo a la literatura sobre convergencia subnacional.

El análisis revela que el índice de libertad económica de casi la totalidad de las provincias canadienses converge en un solo grupo, con la excepción de Quebec, que sigue una trayectoria divergente. Estos hallazgos sugieren que existen al menos dos equilibrios en la libertad económica dentro del país, lo que puede estar vinculado a diferencias estructurales, institucionales o de política económica entre las provincias.

En particular, el caso de Quebec podría estar asociado a un equilibrio institucional distinto, caracterizado por un mayor rol del Estado en la economía, diferencias en la estructura impositiva y regulatoria, y una trayectoria histórica e institucional propia. Estos factores son consistentes con la hipótesis de que la provincia enfrenta incentivos institucionales diferenciados que podrían limitar su convergencia hacia los niveles de libertad económica observados en otras provincias. No obstante, dado que la metodología empleada identifica patrones de convergencia, pero no establece relaciones causales, estas interpretaciones deben entenderse como hipótesis plausibles que requieren análisis adicionales.

El estudio de la convergencia en el índice de libertad económica es importante porque nos permite comprender cómo los diferentes estados o países se acercan o se alejan entre sí en términos de este indicador, proporcionando información clave sobre la calidad institucional y las disparidades en el crecimiento económico. No obstante, la convergencia observada no debe interpretarse necesariamente como deseable per se, sino que su valoración depende de la calidad del equilibrio alcanzado. En este sentido, una convergencia hacia niveles más altos de libertad económica podría asociarse con entornos institucionales más favorables al crecimiento y la eficiencia, mientras que una convergencia hacia niveles bajos no implicaría necesariamente un resultado óptimo desde el punto de vista del bienestar económico.

Estos resultados, que identifican la existencia de al menos dos equilibrios y dinámicas de transición dispares, pueden ser útiles para los responsables del diseño de políticas públicas, tanto a nivel federal como provincial. Desde la perspectiva federal, los hallazgos sugieren que las políticas nacionales orientadas a la armonización regulatoria, la coordinación fiscal y la reducción de distorsiones interprovinciales pueden contribuir a facilitar procesos de convergencia institucional, respetando al mismo tiempo la autonomía provincial característica del sistema federal canadiense. Desde el ámbito provincial, los resultados resaltan la importancia de reformas específicas en materia fiscal, regulatoria y de provisión de bienes públicos, particularmente en aquellas provincias que no convergen, si se busca aproximarse a los niveles de libertad económica observados en el club dominante.

Asimismo, los hallazgos del estudio se vinculan con los debates actuales sobre federalismo fiscal y descentralización en Canadá, en la medida en que muestran que, aun dentro de un mismo marco institucional nacional, persisten diferencias significativas en los arreglos económicos provinciales. La existencia de clubes de convergencia sugiere que la descentralización puede dar lugar tanto a procesos de armonización institucional como a trayectorias divergentes, dependiendo de las decisiones de política adoptadas a nivel subnacional.

Quizá una de las principales limitaciones del trabajo, es que la metodología empleada no explica las razones de estos resultados, simplemente se limita a probar si las unidades de la variable objeto de estudio convergen en su totalidad o lo hacen en diferentes clubes. El presente trabajo abre varías líneas de investigación. En primer lugar, se requiere un análisis más detallado sobre los determinantes de la convergencia y divergencia en libertad económica. Sería relevante evaluar en qué medida factores como la carga fiscal, la estructura regulatoria o la descentralización influyen en la formación de clubes de convergencia.

Otra línea de investigación consiste en aplicar metodologías alternativas, como pruebas de convergencia estocástica, cointegración o modelos de transición de régimen, para contrastar la robustez de los resultados obtenidos con la prueba de Phillips y Sul. Además, un análisis más detallado de los distintos subcomponentes del índice de libertad económica permitiría comprender si la convergencia se da de manera homogénea o si ciertos aspectos, como la libertad empresarial o la seguridad jurídica, muestran patrones de convergencia diferenciados.

Finalmente, dado que la literatura sobre la convergencia de la libertad económica a nivel subnacional es aún incipiente, comparar los resultados de Canadá con otros países federales, como Estados Unidos o Alemania, podría proporcionar una perspectiva más amplia sobre los factores que impulsan o frenan la convergencia en libertad económica.

REFERENCIAS

Apergis, N. and Cooray, A. (2017). Economic freedom and income inequality: Evidence from a panel of global economies - A linear and a non-linear long-run analysis. *The Manchester School*, 85(1):88-105.

Baumol, W. (1986). Productivity growth, convergence, and welfare: What the long-run data show. *American Economic Review*, 76(5), 1072–1085.

Barro, R., y Sala-i-Martin, X. (1991). Convergence across states and regions. *Brookings Papers in Economic Activity*, 1, 107–158.

Barro, R., y Sala-i-Martin, X. (1992). Convergence. *Journal of Political Economy*, 100(2), 223–251.

Bergh, A. and Nilsson, T. (2010). Do liberalization and globalization increase income inequality? *European Journal of Political Economy*, 26(4):488-505.

Carrion-I-Silvestre, J.L. y Gadea, M.D. (2016). Bounds, breaks and unit root tests. *Journal of Time Series Analysis*, 37(2), 165–181.

Carter, J. R. (2007). An empirical note on economic freedom and income inequality. *Public Choice*, 130(1-2):163-177.

Cavaliere, G. (2005). Limited time series with a unit root. *Econometric Theory*, 21(5), 907–945.

Cavaliere, G. y Xu, F. (2014) Testing for unit roots in bounded time series. *Journal of Econometrics*, 178(Part 2), 259–272.

Chang, Y. S., Kim, J., & Kim, Y. S. (2015). Convergence analysis on ten subindexes of economic freedom. International Journal of Public Policy, 11 (1-3), 47-72.

Chen, P., Y. Karavias y E. Tzavalis, E. (2022). Panel unit-root tests with structural breaks. *Stata Journal* 22: 664-678. https://doi.org/10.1177/1536867X221124541.

De Haan, J. y Sturm, J.E. (2000). On the relationship between economic freedom and economic growth. *Eur. J. Polit. Econ*. 16(2), 215–241

Elert, N. y Halvarsson, D. (2012). Economic freedom and institutional convergence ratio. Stockholm, Sweden. Working Paper Number: 196.

Esposto, A.G. and Zaleski, P.A. (1999). Economic freedom and the quality of life: an empirical analysis. *Const. Polit. Econ*. 10(2), 185–197

Gao, C., Ge, H., Lu, Y., Wang, W. and Zhang, Y. (2021). Decoupling of provincial energyrelated CO2 emissions from economic growth in China and its convergence from

1995 to 2017. *J. Clean. Prod*. 297, 126627 https://doi.org/10.1016/j.

jclepro.2021.126627.

Gwartney, J. D., Lawson, R. A., y Holcombe, R. G. (1999). Economic freedom and the environment for economic growth. *Journal of Institutional and Theoretical Economics*, 155(4), 643–663.

Hall, J.C. y Lawson, R.A. (2014). Economic freedom of the world: an accounting of the literature. *Contemporary Economic Policy*, 32(1), 1–19.

Hall, J. C. (2016). Institutional convergence: Exit or voice?, *Journal of Economics and Finance*, 40(4), 829–840.

Hall, J. C., Lacombe, D. J., y Shaughnessy, T. M. (2019). Economic freedom and income levels across US states: A spatial panel data analysis. *Contemporary Economic Policy*, 37(1), 40-49.

Hamit-Haggar, M. (2013). A note on convergence across Canadian provinces: new insights from the club clustering algorithm. *The Annals of regional science*, 50(2), 591-601.

Heckelman, J. C. (2000). Economic freedom and economic growth: a short-run causal investigation. *Journal of Applied Economics* 3(1): 71–91.

Heckelman, J. C. (2015). Economic freedom convergence clubs. In R. J. Cebula, J. C. Hall, F. G. Mixon, & J. E. Payne (Eds.), *Economic behavior, economic freedom, and entrepreneurship* (pp. 102–114). Edward Elgar Publishing.

Juodis, A., Karavias, Y., Sarafidis, V. (2021). A homogeneous approach to testing for Granger non-causality in heterogeneous panels. Empir. Econ. 60, 93–112. http://dx.doi.org/10.1007/s00181-020-01970-9.

Karavias, Y. y E. Tzavalis (2014). Testing for unit roots in short panels allowing for a structural break. *Computational Statistics and Data Analysis* 76: 391-407.
https://doi.org/10.1016/j.csda.2012.10.014

Kallioras, D., Gkotinakou, G., y Fardas, M. (2017). Detecting trends of convergence among the Eurozone countries in terms of economic freedom. *International Journal of Economics and Finance Studies*, 9(1), 33–47.

Lawson, R.A., Murphy, R. y Powell, B. (2020) The determinants of economic freedom: survey. *Contemporary Economic Policy*, 38(4), 622–642.

Lawson, R. (2022) Economic freedom in the literature: what is it good (bad) for? In: *Economic freedom of the world 2022 report*. Canada: Fraser Institute, pp. 1–17.

Naghshpour, S. D., y Nissan, E. (2018). State and regional convergence in economic freedom of North America. *Journal of Regional Analysis and Policy*, 48(2), 48–53.

Newey, W.K. y West, K.D. (1987) A simple, positive-definite, heteroskedasticity and autocorrelation consistent covariance matrix. *Econometrica*, 55(3), 703–708.

Payne, J. E., Saunoris, J. W., Nazlioglu, S., & Karul, C. (2023a). The convergence dynamics of economic freedom across U.S. states. *Southern Economic Journal*, 89(4), 1216–1241.
https://doi.org/10.1002/soej.12629

Payne, J. E., Saunoris, J. W., Nazlioglu, S., & Karul, C. (2023b). Stochastic convergence analysis of US state economic freedom sub-components: Evidence from unit root tests for bounded processes. *American Journal of Economics and Sociology*, 82, 319–348. https://doi.org/10.1111/ajes.12509

Payne, J.E., Saunoris, J.W., Nazlioglu, S. y Sobel, R. (2025). What factors drive cross-country economic freedom convergence?. *Public Choice*, https://doi.org/10.1007/s11127-024-01254-1

Patsoulis, P., Demetriou, D. (2024). Assessing the convergence process of ESG metrics: a research note on the role of economic freedom. *Lett Spat Resour Sci* 17, 18, https://doi.org/10.1007/s12076-024-00383-x

Phillips, P. C., y D. Sul. (2007). Transition modeling and econometric convergence tests.*Econometrica*, 75(6), 1771–1855.

Phillips, P. C., & Sul, D. (2009). Economic transition and growth. *Journal of Applied Econometrics*, 24(7), 1153–1185.

Savoia, A., y Sen, K. (2016). Do we see convergence in institutions? A cross-country analysis. *Journal of Development Studies*, 52(2), 166–185.

Schnurbus, J., H. Haupt, and V. Meier. 2017. Economic transition and growth: A replication. *Journal of Applied Econometrics* 32: 1039–1042.

Serenidou, E. (2023). Reexamining the regional income convergence in Canada [Master's thesis]. University of Macedonia.

Sobel, R.S. y Coyne, C.J. (2011). Cointegrating institutions: the time-series properties of country institutional measures. *Journal of Law and Economics*, 54(1), 111–134.

Villarroya, I. S., y de la Escosura, L. P. (2006). Libertad económica y convergencia en Argentina: 1875-2000. Documento de trabajo, 04.

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