Tourism trends in the Central Region of Portugal: GIS-based cluster and outlier analysis

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Abstract | The Central Region of Portugal is one of socioeconomic and geographic diversity, with its coastal and inland territories, and has valuable touristic resources. In order to promote it in an integrated, organized and planned manner, a knowledge of tourism dynamics and trends is necessary, specifically in the context of demand. Trends related with the annual alphanumeric data for tourist accommodation establishments (hotels, local accommodation and rural tourism/housing): lodging capacity (LC), number of nights (N), average stay (AS), total income (TI) and bed occupancy net rate (BONR), are particularly important to monitor. Based on this assumption, the main objective of this study is to identify distinct groups of municipalities with similar characteristics, namely with high, low and anomalous values (outliers), in this case, with values significantly different from the neighbouring municipalities. Results evidence that great heterogeneity persists in the distribution of the indicators in the different NUTS 3. By applying factor analysis, the relational structure of the indicators is explained by two latent factors (factor 1: LC, N and TI; factor 2: AS) that explain approximately 84% of the total variance.

Keywords | Tourism indicators, tourism statistics, tourism sector, cluster mapping, Central Region

1. Introduction

Recently, the concept of tourism has gained popularity as a means of balancing economic growth, sustainable natural and cultural heritage conservation, and social advancement (Wissink, 2023). With continuous growth over the last decades, tourism in Portugal has consolidated its position as a fundamental activity for the generation of wealth, employment and induction of sustainability. In addition, there has been a diversification of tourist destinations and products, whereby, in addition to the regions of the most historically known cities, others which are less explored in the search for different and more authentic experiences are gaining popularity. In this context, it is essential to highlight the importance of the Região do Centro – Central Region (CR), which is not only rich in historical and cultural heritage, but also has a natural environment which is conducive to outdoor activities, ecological initiatives, and responsible tourism.

The CR of Portugal has an area of 28,199 km^2 and a population of 2 252 648 inhabitants (*Instituto Nacional de Estatística – INE*, 2023a), with its population density recorded at 80 inhabitants per km^2, being the third (out of seven) most populous NUTS 2 in Portugal and the second most extensive. However, it is also the third region in terms of population lost between the last two population censuses (2011 and 2021) (INE, 2022).

The CR incorporates eight sub-regions (NUTS 3) and 100 municipalities (INE, 2015), some located on the coast and others in the interior. It is precisely in the more interior areas that more symptoms of depopulation (INE, 2023b) and socio-economic devitalization can be observed, as is characteristic in interior regions and laggard regions. However, both the coastal and interior areas present touristic resources of excellence. At the same time, there has been a Portuguese plan for the valorization of inland regions, as evidenced in the Tourism Agenda for the Interior. This is a government initiative, promoted by the State Secretariat for Tourism, Commerce and Services, with the aim of bringing value to the territory, investing in companies, qualifying professionals and designing the interior and its offerings (TP, 2023).

The CR of Portugal has great potential to be transformed in a nationally relevant tourist destination due to factors such as the diversity and richness of tourist attractions (e.g. beaches, mountains, spas, historic villages and regional gastronomy) geographic location, good accessibility, the hospitality of residents and competitive prices. However, to be promoted in an integrated manner and for resources to be allocated in an organized and planned way (Eusébio et al., 2008), it is necessary to know tourism dynamics and trends, specifically in the context of demand.

Thus, the aim of this study, with the tourism indicators under analysis, is firstly to analyse the relational structure of the indicators and assess existing differences among the NUTS 3 territorial units in the CR; on the other hand, a parallel aim is to identify distinct groups of municipalities with similar characteristics, namely with high, low and anomalous values (outliers), in this case, with significantly different values from the neighbouring municipalities.

The content that follows is organized into five sections, with section 1 being the introduction. In section 2 the tendencies of market search are explored, while section 3 presents the CR and the methodological procedures of the study. The findings of the study are presented in section 4. The main conclusions, the contributions for theory and practice, limitations and lines for future research can be found in section 5.

2. Tourism trends

More than most sectors of activity, the tourism sector is facing abrupt change at a galloping pace. New tourists look for more differentiated tourism, on a human scale and with personalized treatment, to discover other ways of life and experience authentic and genuine experiences (Tanrisever et al., 2024). They are often informed tourists, with the informational technology having an effective presence (Pato, 2020).

Currently, their demands are influenced by many trends, including environmental concerns, a focus on safety and hygiene, technological advancements, economic conditions, social changes and political factors (IPDT, 2024; Tarlow, 2023). From an ecological perspective, there is a growing demand for sustainable tourism practices that minimize environmental impact and benefit local communities. Tourists are increasingly seeking eco-friendly accommodation, activities that support conservation efforts and destinations that prioritize sustainable development (Santos et al., 2021; Sharpley, 2020). To meet this trend, in Portugal, for instance, the government has launched diverse plans that focus on sustainability. Indeed, the Tourism Strategy 2027 has sustainability as a guiding principle and presents goals and targets to be reached in the three dimensions of sustainability – economic, social and environmental (TP, 2017). The recent plan, "+Sustainable Tourism Plan 2020–2023", was subsequently based on the growing importance of sustainability for the tourism sector and the importance of attaining the 17 United Nations Sustainable Development Goals (SDGs) (Pato & Duque, 2023). In fact, the contribution of tourism to the achievement of the Sustainable Development Goals (SDGs) is now well recognized and incorporated into the United Nations' framework, via a specialized agency known as the World Tourism Organization (UNWTO, 2024).

The search for safety and hygienic territories and accommodation is also a reality. Indeed, in the post-pandemic era, safety and hygiene have become top priorities for travellers. Destinations and service providers are implementing enhanced health protocols and contactless services, and providing clear information about safety measures to reassure tourists (Nogare & Scuderi, 2024; Serra & Seabra, 2023). Because of this "new search", there has been a notable increase in domestic and local travel, partly due to travel restrictions and safety concerns related to international travel (Allan et al., 2022). People are exploring destinations within their own countries, looking for unique, personalized experiences that allow them to connect deeply with the destination. This search leads to a boost in local economies and lesser-known attractions, such as those located in the interior, rural regions (Benítez-Aurioles, 2022).

In an era of economic instability and war, families are increasingly traveling together, encompassing multiple generations (Miyakawa & Oguchi, 2022). This trend involves creating travel experiences that cater to the needs and interests of different age groups, from grandparents to grandchildren.

Moreover, considering the importance of artificial intelligence (AI) and the integration of technology, tourists are impacted by all this combined information. From online booking platforms and mobile apps to virtual reality (VR) tours and AI for personalized recommendations, technology is enhancing the travel experience. Smart tourism, involving the Internet of Things (IoT) and big data analytics, is also on the rise (Aguirre Montero & López-Sánchez, 2021; Rosário & Dias, 2024). The integration of technology has also positively impacted remote work and digital nomadism,

leading to the emergence of digital nomad communities (Zhou et al., 2024). Many destinations are adapting by offering remote work-friendly amenities and promoting long-stay options.

These evolutionary trends presuppose the need for new, more global, innovative management and partnerships, using new instruments and attractions, and relying on new tools for planning and developing territories as a whole (Ramos & Costa, 2017) and their regions. In particular, the recent trends in travel and tourism are reshaping the way visitors engage with the CR, driven by changing traveller preferences, the rise of sustainability concerns, and new technologies.

3. Presentation of the region under study and methodological procedures

3.1. The Central Region

The CR is one of the five NUTS 2 of mainland Portugal. It is located in the centre of the country, occupying 25.7% of the mainland and consists of eight sub-regions (NUTS 3): Beira Baixa, Beiras and Serra da Estrela, Médio Tejo, Oeste, Aveiro Region, Coimbra Region, Leiria Region and Viseu Dão-Lafões (INE, 2015) (Figure 1). The largest municipalities, in terms of area, are Castelo Branco and Idanha-a-Nova in Beira Baixa, but the most populous is the municipality of Coimbra (INE, 2022).
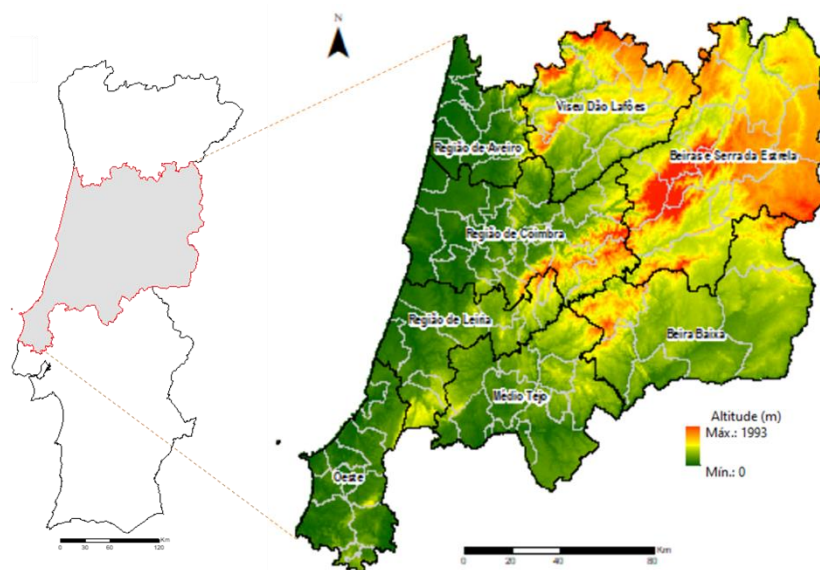

Figure 1 | Location of the Central Region in mainland Portugal
Source: Own design

Regarding its economic structure, the CR is composed by a territory marked by diverse diversity, natural resources, economy (essentially with three types of production systems, dependent on local resources, technological activities and tourism) and settlement, involving subregional urban systems organized according to a polycentric, specialized, sustained model and recognized quality

of urban life, with very strong internal asymmetries. It is precisely in the interior of the CR that more evidence of poverty, underdevelopment and demographic decline can be found. The interior regions (NUTS 3) with the lowest density in the CR, in addition to the risk of demographic decline becoming here a vicious circle of development, faced with the continuity and persistence of forest fires in recent years. For these reasons, a clear intensification of the vulnerability and a significant deterioration in the perception of living conditions of more interior regions can be observed here (CCDRC, 2020).

However, the change in perceptions upon the outbreak of the COVID-19 pandemic suggested, for example, demand for some types of products and services precisely found in these interior regions. This is the case of the demand for rural, nature and gastronomic and wine tourism, health and wellness tourism, and cultural tourism, products that in recent years have been extremely emphasized.

Indeed, beyond the resources and products found in the littoral regions (with sun and sea tourism, religious tourism in Fátima, and medieval tourism in Óbidos, among others), other products and resources in the interior regions are continually more sought. The association of these interior territories with a greater demand for tourism will require more continuous monitoring and more persistent planning for all the CR.

3.2 Methodological procedures

The annual alphanumeric data related to the tourism indicators for tourist accommodation establishments (hotels, local accommodation and rural tourism/housing), lodging capacity (LC), number of nights (N), average stay (AS), total income (TI) and bed occupancy net rate (BONR), for the 100 municipalities of the CR, from 2017 to 2022, were obtained from INE. In terms of cartographic data to delimit the study area and its municipalities and NUTS 3, the Official Administrative Map of Portugal, 2023 version, from the Directorate-General for Territory, was used. Statistical analysis was performed using IBM SPSS 29.0.1 and R 4.3.2, integrated with the GIS application ArcGIS Pro 3.2.

Considering the objectives of the study, we started with a descriptive analysis of the annual tourism indicators in the NUTS 3 of the CR. To determine possible differences in the indicators between NUTS 3, ANOVA was used for the indicators that checked the assumptions and the Kruskal-Wallis test for the others, followed by post-hoc tests. The relational structure of the indicators was evaluated by factor analysis with extraction of factors by the principal component method followed by a varimax rotation, with a KMO = $0.783 \approx 0.8$. ($X^2(1)$ = 629,946; $p < 0.001$). The retained factors were those that presented an eigenvalue greater than 1. All analyses were done for α = 5%.

To analyse the distribution patterns of each tourism indicator in 2017 and 2022, the ArcGIS Pro Cluster and Outlier Analysis tool was used for the spatial association of municipalities. In this geostatistical technique, used to identify clusters of municipalities with high or low values, as well as to identify spatial outliers, the proximity criterion (neighbourhood) was defined as municipalities whose geometric boundaries share at least one vertex and the Euclidean distance was used as the method for calculating the distance between two municipalities. For each municipality i, based on the calculation of the local Moran's I value, a z-score is calculated using the formula:

$$z_{I_i} = \frac{I_i - E[I_i]}{\sqrt{V[I_i]}}$$

where

$$E[I_i] = -\frac{\sum_{j=1, j \neq i}^{n} \omega_{i,j}}{n - 1}$$

$$V[I_i] = E[I_i^2] - E[I_i]^2$$

A positive z-score indicates that a municipality and its neighbours belong to a cluster of high (HH) or low (LL) values. In turn, a negative value identifies outliers, municipalities with significantly different values from their neighbours, i.e. a low value surrounded by high values (LH), or a high value surrounded by low values (HL). Clusters and outliers are considered statistically significant (p < 0.05)

4. Results

There was great heterogeneity in the distribution of the indicators in the different NUTS 3 of the CR: 50% of the tourist accommodation establishments had a LC greater than or equal to 256 beds and a number of nights greater than to 20201; an AS greater than or equal to 1.77 nights; TI greater than or equal to 919 thousand euros and a BONR greater than or equal to 23.42%. The Oeste Region stands out in LC, N and TI with averages, respectively, of 903.71±220.49 beds, 93971.92±25991.70 nights and 5722.63±1867.44 thousand euros, as well as the Aveiro Region with an average BONR of 28.41±2.72 % and the Coimbra Region with an AS of 2.06±0.12 nights (Table 1). In terms of municipalities, Tábua and São Pedro do Sul stand out with an AS of more than three nights and Aveiro and Nazaré with a BONR of more than 42%.

Table 1 | Descriptive statistics and comparison of the indicators under study by NUTS 3 (ANOVA and Kruskal-Wallis test)

		Beira Baixa	**Beiras Serra da Estrela**	**Médio Tejo**	**Oeste**	**Aveiro Region**	**Coimbra Region**	**Leiria Region**	**Viseu Dão Lafões**
Lodging capacity (N)	$\bar{x} \pm se$	295.56 ± 102.93	535.66 ± 132.29	882.72 ± 619.81	**903.71** ± 220.49	526.95 ± 170.09	621.93 ± 229.46	454.65 ± 202.45	441.73 ± 153.51
	Median	176.50	296.67	146.00	**825.08**	277.50	231.33	136.20	170.83
	Maximum	680.50	2024.50	**8269.83**	1976.83	2089.67	3896.00	2035.67	1773.00
Nights (N)	$\bar{x} \pm se$	26250.42 ± 12779.30	47507.40 ± 16292.85	81780.01 ± 59669.19	**93971.92** ± 25991.70	61072.88 ± 26774.62	66859.74 ± 30281.21	45696.19 ± 22510.13	34035.28 ± 14780.32
	Median	10794.42	20427.67	14071.00	**68084.42**	20835.67	24305.17	10624.83	9636.96
	Maximum	86007.67	253911.17	**792658.83**	209317.00	316720.50	547123.83	226658.67	194030.50
Average stay (N)	$\bar{x} \pm se$	1.90 ± 0.10	1.62 ± 0.05[a,b]	1.70 ± 0.07	1.99 ± 0.07[a]	1.94 ± 0.11	**2.06** ± 0.12[b]	1.82 ± 0.12	1.95 ± 0.14
	Median	1.80	1.60	1.62	**1.99**	1.97	1.90	1.74	1.75
	Maximum	2.35	2.08	2.23	2.60	2.50	**3.48**	2.55	3.27
Total income (thousand €)	$\bar{x} \pm se$	1252.36 ± 563.96	2613.81 ± 934.46	3543.40 ± 2471.69	**5722.63** ± 1867.44	2874.97 ± 1176.27	3213.56 ± 1380.98	2081.92 ± 984.47	1585.69 ± 674.96
	Median	530.42	920.50	451.50	**3413.92**	1311.50	918.00	593.83	786.42
	Maximum	3851.00	14153.83	**32836.67**	18335.33	13969.17	24992.83	9393.33	9116.33
Bed occupancy net rate (%)	$\bar{x} \pm se$	22.88 ± 3.15	22.12 ± 2.18	22.68 ± 2.23	**28.56** ± 2.74	28.41 ± 2.72	26.71 ± 1.85	24.59 ± 2.50	19.20 ± 1.12
	Median	20.02	21.68	24.85	**28.65**	27.82	26.93	26.24	18.21
	Maximum	35.42	38.32	34.18	**42.22**	42.65	41.50	35.75	30.73

The Kruskal-Wallis test revealed that, regarding AS, there are significant differences between the Beiras and Serra da Estrela and the Regions of Coimbra and Oeste (p < 0.05), and coastal regions seem to have greater benefit. For the other indicators, there were no significant differences between the NUTS 3 (Table 1).

By applying factor analysis and according to the rule of eigenvalue greater than 1, the relational structure of the indicators is explained by two latent factors that explain approximately 84% of the total variance and show that AS is discriminated from the other indicators. The parameters with the greatest weight are highlighted in each component (Table 2). This result reinforced the importance of the indicators LC, N and IT for the development of tourism in the region and of AS for the extension of the stay.

Table 2 | Factor weights of each index in the two factors retained, eigenvalue and percentage of explained variance

	Factor 1	**Factor 2**	**Communalities**
Lodging capacity (N)	**0.956**	− 0.025	0.914
Nights (N)	**0.985**	− 0.044	0.972
Average stay (N)	− 0.037	**0.994**	0.989
Total income (thousand €)	**0.979**	− 0.021	0.958
Bed occupancy net rate (%)	0.587	− 0.109	0.357
Eigenvalue	3.188	1.001	
Variance Explained	63.77%	20.02%	

The first factor presents high weights of LC, N and TI and explains 63.77% of the total variance. The second factor, with the high factor weight of AS, explains 20.02% of the total variance. As the commonalities are high, it shows that both factors are appropriate to describe the correlational structure between the indicators. It should be noted that BONR has a moderate weight in factor 1 with a low commonality, which may mean that it contributes little to the factorial solution. The following figure illustrates the distribution of the factor weights of the indices and shows which ones define each of the components more intensely.
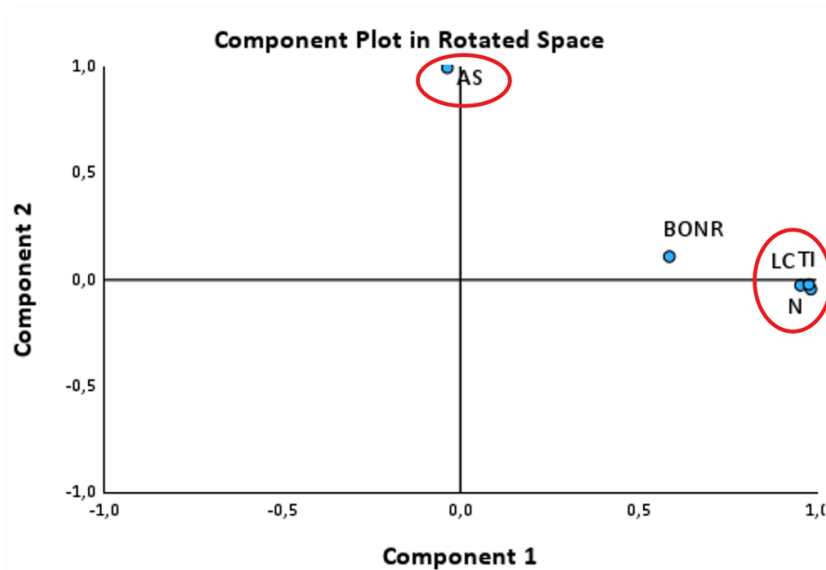
Figure 2 | Factor weights of the indicators under study after factor analysis followed by varimax rotation

The application of the cluster and outlier analysis allowed identification of whether the values of a municipality and its neighbours were significantly different from the study area for each tourism indicator, i.e. if both the municipality and the neighbourhood had very different values from those of the study area.

Thus, it was possible to verify that none of the municipalities in Beira Baixa presented a significant spatial pattern in any of the indicators analysed in either 2017 or 2022. For each indicator, a summary of the main results obtained in the municipalities of the remaining NUTS 3 is presented below.

With regard to LC, the municipality of Leiria stands out for having the same HH pattern in 2017 and 2022, in contrast with Figueiró dos Vinhos, Lousã, Penela and Sertã, which had an LL pattern. On the other hand, the municipalities of Batalha, Ferreira do Zêzere, Pombal and Torres Novas recorded outlier HL patterns. The following showed a negative evolution: Marinha Grande (HH in 2017), Alvaiázere, Castanheira de Pêra, Góis, Pedrógão Grande (LL in 2022) and Castro Daire (LH in 2022). Despite the evolution towards a non-significant spatial pattern, the municipalities of

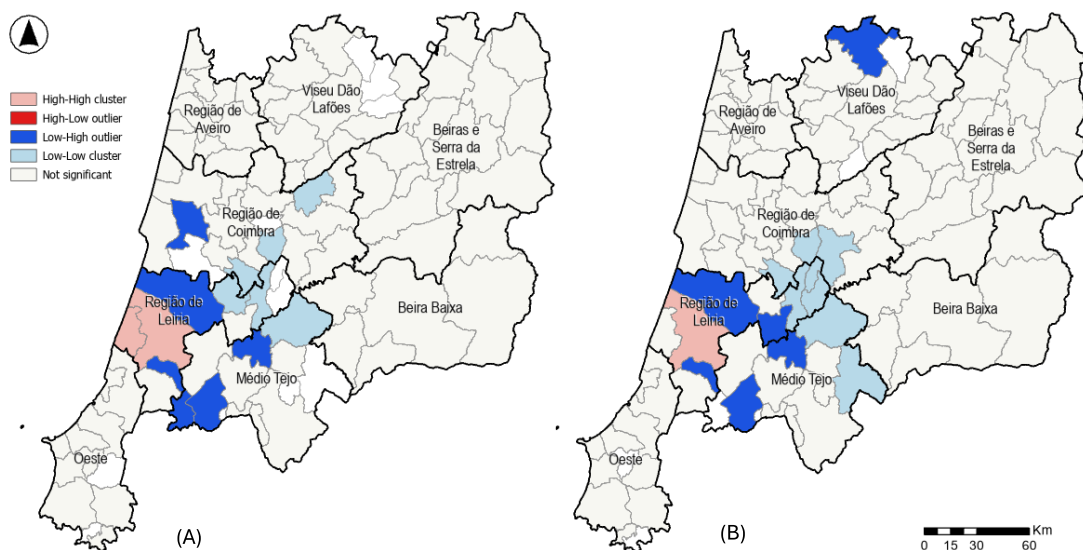Montemor-o-Velho (LH in 2017) and Ansião and Tábua (LL in 2017) should also be mentioned (Figure 3).

Figure 3 | Cluster and outlier analysis for lodging capacity (LC): (A) 2017 data; (B) 2022 data

Source: Own design

In terms of the number of nights, Ílhavo stands out for its evolution to HH and Leiria for maintaining this pattern in 2017 and 2022. The spatial patterns were maintained: LL – Sertã; LH – Alcanena, Alvaiázere, Batalha, Pombal and Torres Novas. Although there was an evolution towards a non-significant pattern, it is important to mention: Ferreira do Zêzere (LH in 2017); Penela, Tábua and Trancoso (LL in 2017). The municipalities report a negative trend in 2022: LL – Lousã and Arruda dos Vinhos; LH – Cantanhede and Montemor-o-Velho (Figure 4).
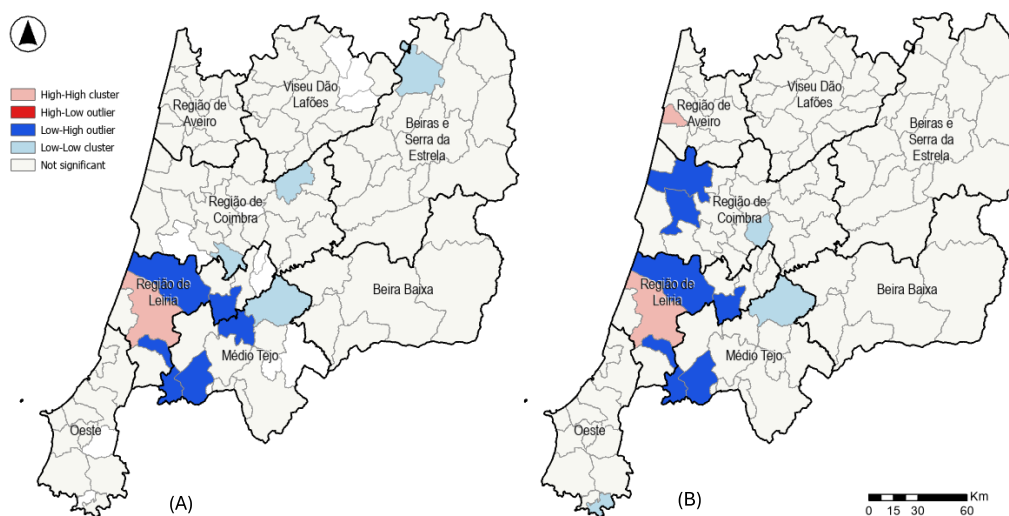

Figure 4 | Cluster and outlier analysis for number of nights (N): (A) 2017 data; (B) 2022 data

Source: Own design

Regarding AS, as they register a significant spatial pattern of improvement, it is important to highlight: Cantanhede, Figueira da Foz, Góis, Mira, Oliveira do Bairro, Pedrógão Grande, Sertã and Vouzela (HH in 2022), as well as Nelas and Vila Nova de Poiares (HL in 2022). It is important to highlight the municipality of Tábua, which maintained the HL outlier standard. On the negative side, Almeida, Figueira de Castelo Rodrigo, Guarda, Pinhel and Sabugal are mentioned, which maintained the pattern of municipalities with low values surrounded by a neighbourhood of low values. In addition, there was a downward trend in the values of the municipalities of: Torres Novas and Vila Nova da Barquinha (LL in 2022); Figueiró dos Vinhos (HL in 2017) and Penela (LL in 2017) (Figure 5).
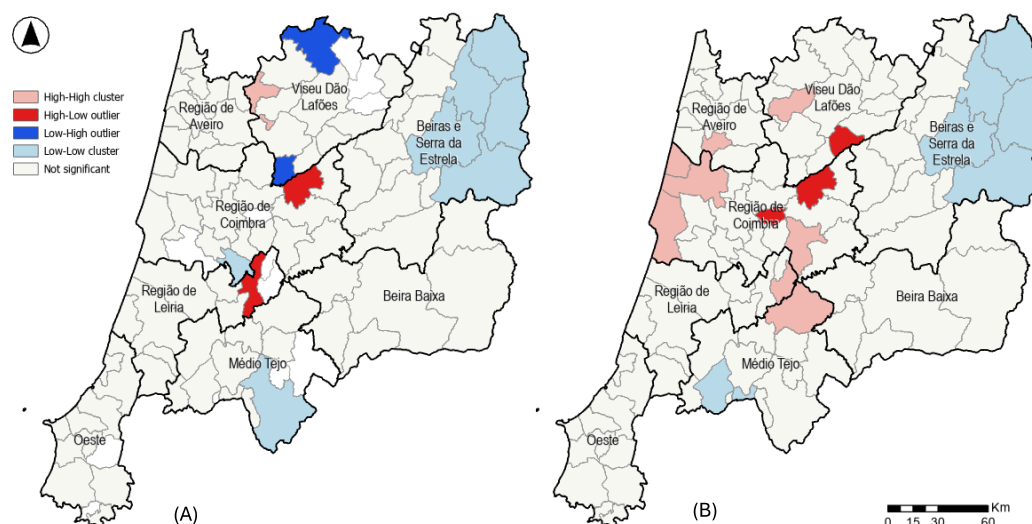

Figure 5 | Cluster and outlier analysis for average stay (AS): (A) 2017 data; (B) 2022 data
Source: Own design

In terms of the TI indicator, Leiria maintained high values in 2017 and 2022 and the municipalities of Lousã and Sertã continued to record low TI. In addition, the municipalities of Batalha, Lourinhã and Pombal maintain the pattern of municipalities with low values surrounded by a neighbourhood with high values. On the other hand, although not significant, Penela (LL in 2017), Alcanena and Torres Novas (LH in 2017) showed an improvement. The weakening trend includes Cantanhede and Montemor-o-Velho (LH in 2022) and Pedrógão Grande (LL in 2022) (Figure 6).
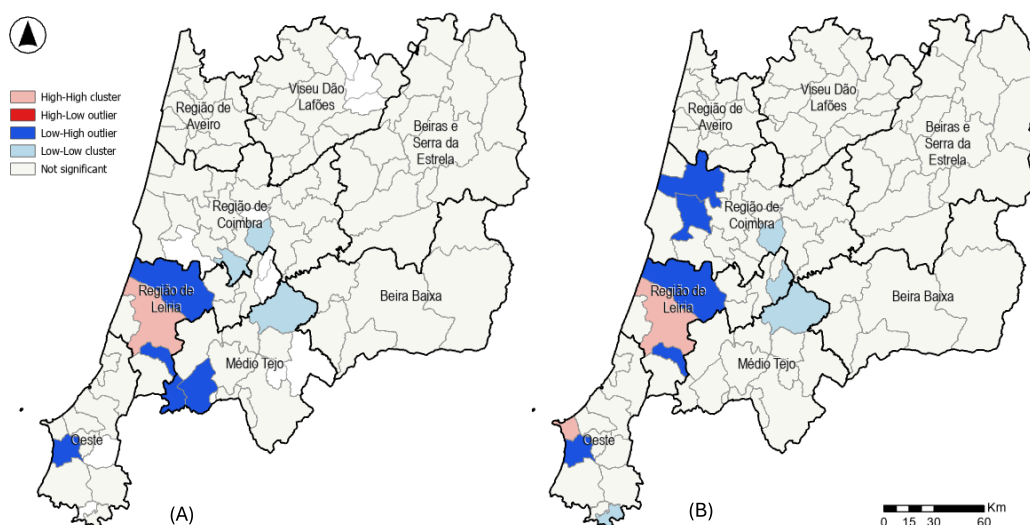
Figure 6 | Cluster and outlier analysis for total incomes (TI): (A) 2017 data; (B) 2022 data

Source: Own design

Regarding the BONR, the municipalities of Alcobaça and Murtosa stand out for maintaining a spatial pattern of high values, and Aveiro, Cantanhede, Ílhavo and Vagos are notable for their evolution to this standard. The municipalities of Mêda, Torres Vedras and Viseu are also noteworthy, as they show progress towards the standard of municipalities with high values surrounded by a neighbourhood with low values. It is also worth mentioning Condeixa-a-Nova for its progress, although for a non-significant spatial pattern (LH in 2017) (Figure 7).
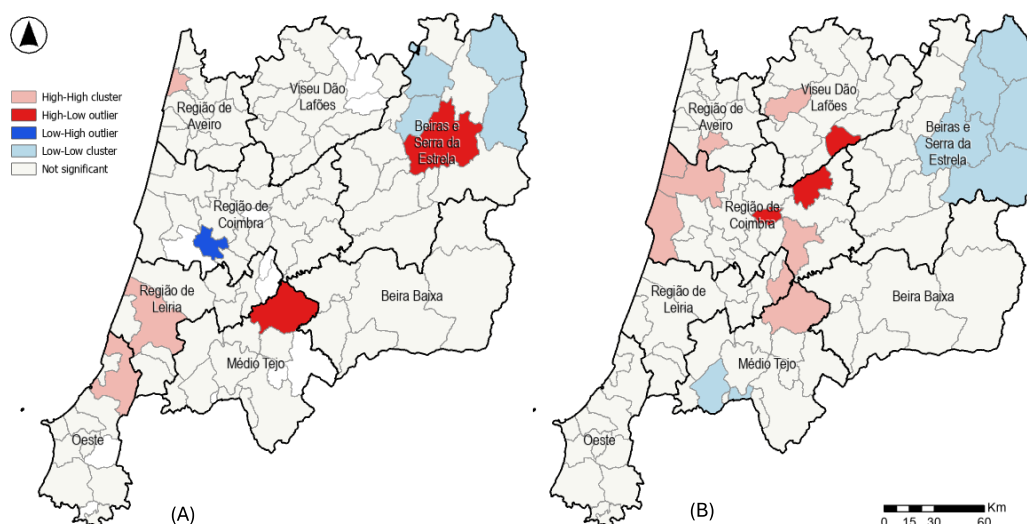

Figure 7 | Cluster and outlier analysis for bed occupancy net rate (BONR): (A) 2017 data; (B) 2022 data

Source: Own design

In addition, the development trend of Almeida and Celorico da Beira (LL in 2017) may have influenced the change in the spatial pattern of the municipalities of Guarda (HL in 2017) and Fornos de Algodres (LL in 2022). Still a source of attention is not only Figueira de Castelo Rodrigo and Trancoso, for maintaining the LL standard, but also the municipalities of Albergaria-a-Velha, Oliveira do Bairro and Sobral de Monte Agraço for drop to the HL standard in 2022 (Figure 7).

5. Conclusion

The growing availability of more and better data on the tourism sector in Portugal is encouraging the design and improvement of planning and management tools based on the study of causal effects and orientated towards results. To achieve this goal, it is essential to use evidence obtained from more efficient and innovative statistics and methodologies. In this study, despite a positive trend in all the annual tourism indicators analysed, with 2022 reaching 2017 levels, with the exception of the number of overnight stays, it became clear that it is essential to produce relevant information to support decision-making in the development of the CR.

Indeed, the transformation of the CR into a major tourist destination necessarily involves defining appropriate strategies and plans for integrated development of the entire region (Eusébio et al., 2008). Furthermore, the recent 'Strategy for Tourism 2027' also presents five key principles and factors (people, freedom, openness, knowledge and collaboration) to realize the ambition of transforming Portugal into a smarter and more dynamic tourist destination. Clearly, this also extends to the CR as a whole. Such an aspiration can only be possible with the co-operation and involvement of all its public and private stakeholders (from different regions and municipalities) (TP, 2017).

In this context, cluster and outlier analysis has proved fundamental for monitoring and improving processes, since in order to encourage the formation of networks to help overcome the obstacles imposed by competitiveness and constant change in the environment, it is essential to identify more similar municipalities mapping significant hot spots, cold spots and spatial outliers.

The location of municipalities with high values compared to the average for municipalities in the CR, and the fact that neighbouring municipalities also have values above this average, has highlighted the need for coordinated management strategies between municipalities and neighbouring municipalities. A variety of activities and attractions needs to be offered that meet the interests and preferences of visitors (culture, nature, gastronomy, transport, sports, family programs, among others), guaranteeing diversity and quality.

In turn, the detection of municipalities with low values surrounded by municipalities also with values lower than the average for the CR evidenced a possible need to create a joint, coordinated plan with neighbouring municipalities and other strategic partners, thus providing a more favourable environment for the growth and sustainability of tourism projects. For example, due to

the finding of low AS values in the frontier municipalities of Beiras and Serra da Estrela the adoption of marketing strategies is recommended to promote the tourist potential of the region through a balanced offer of leisure, culture and nature options that can attract tourists and encourage them to extend their stay.

Nevertheless, Dupeyras & MacCallum (2013:7) define tourism competitiveness for a destination as 'the ability of the location to optimize its attractiveness to residents and non-residents, to provide quality, innovative and attractive tourism services (e.g. providing value for money) to consumers and to gain market shares in national and global markets, while ensuring that available resources supporting tourism are used efficiently and sustainably way'.

Thus, identifying municipalities with high values while their neighbours have low values has made it possible to locate municipalities that have great potential for change. In this sense, through an integrated strategy, neighbouring municipalities could benefit from promoting local culture and improving tourist infrastructure, particularly in terms of transport and partnerships with travel/tourism agencies.

Furthermore, recognising municipalities with lower values surrounded by municipalities with high values highlights the possible attractiveness of these municipalities. In fact, integrated inter-municipal cooperation with neighbouring municipalities, involving local communities in tourism projects, can ensure that the benefits are widely distributed. Indeed, as Calvados & Kastenholz (2017) state, a win-win relationship strategy between all stakeholders, anchored in co-operative networks and value creation, is crucial.

The emergence of big data has brought with it new challenges and opportunities, and innovative approaches are needed to explore and enjoy all that the CR has to offer, in order to attract and retain visitors and thus stimulate the local economy, encourage environmental preservation and ensure the long-term sustainability of tourism.

Objectively, decentralized and dynamic inter-municipal cooperation, in a segment as important as tourism, can greatly contribute to regional sustainability and growth, as well as making it possible to jointly exploit and promote local resources, making these municipalities more competitive.

Summing up, this study has shown that the development of tools in which various data sources and real-time analysis are integrated in a multiplatform, user-friendly and remotely accessible environment, using innovative methodologies such as those used in this study, can be a value-added proposition and a competitive advantage for the tourism sector.

This study naturally has limitations. It is only based on quantitative analysis, so, in the future, in order to get a more understanding of the potentialities and weaknesses of the regions and municipalities of the CR, it would be interesting to complement this analysis with a more qualitative study. Qualitative analyses involving important stakeholders that promote tourism development (e.g., lodgings units, animation tourist enterprises, regional associations, municipalities), would enable a triangulation of the findings and a more in-depth understanding of the results.

References

Aguirre Montero, A., & López-Sánchez, J. A. (2021). Intersection of data science and smart destinations: A systematic review. *Frontiers in Psychology, 12*, 712610.

Allan, G., Connolly, K., Figus, G., & Maurya, A. (2022). Economic impacts of COVID-19 on inbound and domestic tourism. *Annals of Tourism Research Empirical Insights, 3*(2), 100075. https://doi.org/10.1016/j.annale.2022.100075

Benítez-Aurioles, B. (2022). Territorial Impact of COVID-19 on Tourism. An Opportunity for Rural Development in Spain. *Ager, 35,* 99-130. https://doi.org/10.4422/ager.2022.12

CCDRC. (2020). Visão estratégia para a Região Centro 2030: CCDRC.

Dupeyras, A., & MacCallum, N. (2013). Indicators for Measuring Competitiveness in Tourism: OECD.

Eusébio, C. A., Castro, E. A., Costa, C. (2008). Diversidade no Mercado Turístico da Região Centro de Portugal. *Revista Turismo e Desenvolvimento, 10*, 10-24. https://doi.org/10.34624/rtd.v0i10.13555

INE. (2023a). *Estatísticas Demográficas 2021*. INE.

INE. (2023b). Índice Sintético de Desenvolvimento Regional. Retrieved from https://www.ine.pt/xportal/xmain?xpid=INE&xpgid=ine_destaques&DESTAQUESdest_boui=594882965&DESTAQUESmodo=2

INE. (2022). *Censos Resultados Definitivos 2021*. INE.

INE. (2015). *NUTS 2013 As Novas unidades territoriais para fins estatísticos*. INE.

IPDT. (2024). 10 Tendências de Viagem para 2024. Retrieved from https://www.ipdt.pt/tendencias-viagem-turismo/

Miyakawa, E., & Oguchi, T. (2022). Family tourism improves parents' well-being and children's generic skills. *Tourism Management, 88*, 104403. https://doi.org/10.1016/j.tourman.2021.104403

Nogare, C., & Scuderi, R. (2024). Tourist perceptions of health-safety risks in a time of pandemic. *Journal of Economic Studies* (Vol. ahead-of-print). https://doi.org/10.1108/JES-09-2023-0506

Pato, L., & Duque, A. S. (2023). Strategic Issues in Portuguese Tourism Plans: An Analysis of National Strategic Plans since 2000. *Sustainability, 15(7)*, 5635.

Pato, L. (2020). The importance of eco-labels certifications and ict in the promotion of sustainable tourism – case study of a rural tourism unit. *Millenium: Journal of Education, Technologies, and Health, 2*(Especial 5), 369-377. https://doi:10.29352/mill0205e.37.00242

Ramos, D. M., & Costa, C. M. (2017). Turismo: tendências de evolução. *PRACS: Revista Eletrônica de Humanidades do Curso de Ciências Sociais da UNIFAP, 10*(1), 21-33.

Rosário, A. T., & Dias, J. C. (2024). Exploring the Landscape of Smart Tourism: A Systematic Bibliometric Review of the Literature of the Internet of Things. *Administrative Sciences, 14*(2), 22.

Santos, V., Sousa, M. J., Costa, C., & Au-Yong-Oliveira, M. (2021). Tourism towards sustainability and innovation: A systematic literature review. *Sustainability, 13*(20), 11440.

Serra, P. V., & Seabra, C. (2023). Hygiene and Health in Tourism, in a Post-Pandemic Context: From Expected Requirement to Mandatory Criterion. In C. Seabra and M. E. Korstanje (Eds.), *Safety and Tourism*, 195-215: Emerald Publishing Limited.

Sharpley, R. (2020). Tourism, sustainable development and the theoretical divide: 20 years on. *Journal of sustainable tourism,* 28(11), 1932-1946.

Tanrisever, C., Pamukçu, H., & Sharma, A. (2024). Future tourism trends volume 1: Tourism in the changing world. Emerald Publishing Limited.

Tarlow, P. (2023). Rethinking tourism: where is it going and how will it impact people and planet? A personal perspective. *Worldwide Hospitality and Tourism Themes,* 15(6), 617-624. https://doi.org/10.1108/WHATT-09-2023-0110

TP. (2023). Agenda do Turismo para o Interior. Retrieved from https://www.turismodeportugal.pt/pt/Turismo_Portugal/Estrategia/agenda-turismo-interior/Paginas/default.aspx

UNWTO. (2024). Statistical Framework for Measuring the Sustainability of Tourism (SF-MST): Final Draft. World Tourism Organization. https://unstats.un.org/UNSDWebsite/statcom/session_55/documents/BG-4a-SF-MST-E.pdf

Zhou, L., Buhalis, D., Fan, D. X. F., Ladkin, A., & Lian, X. (2024). Attracting digital nomads: Smart destination strategies, innovation and competitiveness. *Journal of Destination Marketing & Management,* 31, 100850. https://doi.org/10.1016/j.jdmm.2023.100850