

# INTERDEPENDENCE BETWEEN THE TOURIST REGIONS OF SERGIPE, BRAZIL

## ABSTRACT

We constructed an interregional input-output system for the tourist regions of Sergipe and identified the contribution of Tourism Characteristic Activities (TCAs) to the state's economy. It is the first system built for tourist regions in Brazil that disaggregates tourism activities by sector and region, representing a novel approach in Brazilian literature. By measuring the weight of tourist activities, we avoid overestimating tourism in the regional economy. Researchers can use this method for countries and regions that do not have a Tourism Satellite Account. The main results estimate that TCAs in Sergipe accounted for 1.53% of the state's gross value added (GVA) in 2015, 3.7 times lower when considering only tourism activities. The Polo Costa dos Coqueirais stands out among the tourist regions, particularly regarding the distribution of TCAs' GVA within the state. Tourist road transportation is considered a key sector in all tourist regions.

Keywords: Tourist Activities, tourist regions, input-output, Sergipe.

Jel-codes: C67; R15; Z32.

## INTRODUCTION

Recent years have begun to show a scenario of world recovery in tourist activity, which had been severely affected by the COVID-19 pandemic. In 2019, according to the World Travel & Tourism Council's annual Economic Impact Report (EIR) data, tourism accounted for 10.3% of the world's Gross Domestic Product (GDP). In 2021 and 2022, however, this share dropped to 6.1% and 7.6%, respectively, which is still below the pre-pandemic levels. Brazil, an important tourist destination in South America, was also severely impacted by the pandemic. Ribeiro et al. (2021) estimated a 31% drop in the GDP of Brazilian tourist activities in 2020.

In this present scenario of recovery in the sector, the existence of based on concrete planning instruments is fundamental. Tourism is an important development alternative for poorer countries or regions. In Brazil, tourism has already been used explicitly as a regional development policy through PRODETUR Nacional, specifically in the Northeast region - PRODETUR NE I and II. Studies by Haddad et al. (2013) and Ribeiro et al. (2017; 2022) show that tourism reduces regional inequalities in the country.

The scarcity of resources in poorer states, often located in peripheral regions, contributes to the fact that tourism policy is not a priority in state public management, as is the case of Sergipe, located in the Brazilian Northeast. Sergipe is the smallest state in the country in territorial terms and accounts for 4% and 0.6% of regional and national GDP, respectively. Although the state has tourism potential in several segments (sun and beach, adventure, and historical-cultural), they are not fully exploited.

Constructing tools that can aid tourism planning is fundamental for tourism development. Thus, this paper aims to build an inter-regional input-output (IO) system for Sergipe's tourist regions and identify the contribution of Tourism Characteristic Activities (TCAs) to the state economy. Although many studies have used the IO model to estimate the intra and inter-regional economic effects of activities associated with tourism (Polo and Valle, 2008; Lee et al., 2020; Lee and Hlee, 2021; Kumara et al., 2021), the evaluation of the productive and regional interdependence of TCAs has been little explored in the literature. For the Brazilian case, some studies measure the economic contribution of tourism in specific regions, but they do not consider the inter-regional interdependence of TCAs.

Cassimiro Filho and Guilhoto (2003) built an IO model for the tourist economy in Brazil in 1999 and measured intersectoral linkages and the ability to induce investments in economic growth. Takasago and Mollo (2011) examined the potential for stimulating production growth, income generation, and employment in the Federal District. To do so, they use the Input-Output

Matrix (IOM) to calculate the linkage effects and the potential generators of production, employment, and tourism income, enabling a more accurate sectorial view.

Souza et al. (2015) use an interregional IOM for Brazil to analyze the economic contribution of tourism in the Northeast region. Based on this, the authors seek to measure the influence of tourism on job and income generation, as well as its impact on reducing labor income inequality.

Gonçalves et al. (2020) propose a method to measure the size of TCAs and their evolution in the Brazilian economy and its states between 2010 and 2015. The method consists of measuring TCAs on the supply side, using the same techniques employed to measure activities within the scope of the System of National and Regional Accounts of Brazil. They estimate a structure of weights applied to the value-added of economic activity groups.

By employing an inter-regional input-output (IO) system, the study avoids potential overestimations of the economic contribution of tourism by disaggregating TCAs. This methodological insight not only enhances the precision of the findings for Sergipe but also provides a valuable approach for regions and countries globally facing similar challenges in accurately assessing the economic impact of tourism. The study's focus on trade flow dynamics, value-added concentration, and employment multipliers within different tourist regions of Sergipe adds depth to the understanding of the economic intricacies of the tourism industry at a regional level.

Moreover, identifying key sectors provides tangible insights for policymakers and researchers promoting sustainable tourism development. While the research refrains from making explicit cross-regional or cross-national comparisons, its emphasis on precise regional data offers a rich foundation for future comparative studies. Additionally, the research highlights the need for tailored policies in Sergipe, leveraging regional production chains. This focus on practical applications adds depth to the broader international discourse on effective tourism planning and

development, making it pertinent to a global audience of researchers, policymakers, and practitioners navigating the complexities of regional economic recovery and growth.

Despite efforts in the national literature to assess the productive interdependence of TCAs in Brazil, no study simultaneously deals with the regional and sectoral specification of tourist activities. Our main contribution, therefore, is: i) to regionally disaggregate the weight of trade flows from tourist activities and ii) to provide a tourism planning tool for Sergipe to encourage tourism development. In other words, this paper offers an unprecedented database for Brazil and Sergipe by sectorally and regionally disaggregating tourist activities. The method for estimating tourism can be replicated in countries and regions without a Tourism Satellite Account, such as Brazil. The disaggregation of the TCAs avoids overestimating the effects of tourism on the state economy.

#### TOURIST REGIONS OF SERGIPE

Sergipe possesses considerable untapped potential in tourism. The state is subdivided into five distinct regions, each contributing to a diverse landscape encompassing sunlit beaches, rugged mountains, and historically rich towns, as we can see in Figure 1. However, realizing this potential is contingent upon addressing existing challenges.

<Insert Figure 1>

The city of Aracaju, the dynamic capital, anchors the bustling Polo Costa dos Coqueirais. This region represents Sergipe's economic and tourism epicenter, characterized by pristine beaches. It serves as the primary gateway to the various wonders scattered throughout Sergipe. Beyond the coastal allure, Polo dos Tabuleiros and Polo Serras Sergipanas unfold a narrative of rolling hills and charming towns while the canyons of Polo Sertão das Águas, particularly the iconic Xingó Canyons, beckon adventure enthusiasts.

The Brazilian Tourism Map defined the tourist regions of Sergipe (Brazil, 2022). In general, this document guides the preparation and implementation of public policies by the Ministry of Tourism. In Brazil 2021, 338 tourist regions were defined, of which five belong to the state of Sergipe, as shown in Table 1. Only some municipalities are part of a tourist region since they must meet criteria jointly established by state agencies and the Ministry of Tourism. Municipalities are categorized (A, B, C, D, or E) due to the performance of their tourism economy.

<Insert Table 1>

Of the 75 Sergipe municipalities, 45 were included in the Tourism Map and constituted the formation of five tourist regions in the state, as we mentioned: Polo Costa dos Coqueirais, Polo dos Tabuleiros, Polo Serras Sergipanas, Polo Sertão das Águas, and Polo Velho Chico. Most municipalities in Sergipe were classified in Categories "D" and "E," which indicates that tourist activity is incipient in most of Sergipe. This is not a particularity of Sergipe since, according to Santos et al. (2018), the supply structure of labor in the tourism sector is incipient in 90.6% of Brazilian municipalities. Only the capital, Aracaju, was classified as Category "A". Table 2 shows some indicators of Sergipe's tourist regions for 2020 to understand this regionalization better.

<Insert Table 2>

Polo Costa dos Coqueirais is home to almost 50% of the state population and accounts for approximately 55% of Sergipe's GDP. This tourist region aggregates all the municipalities that form the Metropolitan Region of Aracaju (Aracaju, Barra dos Coqueiros, Nossa Senhora do Socorro and São Cristóvão). On the other hand, Polo dos Tabuleiros accounts for 5.19% of the state's GDP. Although Polo Velho Chico has one of the main tourist destinations in the state, the Xingó Canyons, its GDP per capita, the highest among tourist regions, is justified by the

presence of the São Francisco Hydroelectric Company, as pointed out by Ribeiro and Jorge (2019).

Despite these unique offerings, several municipalities in Sergipe remain relatively unnoticed, categorized as "developing" or "emerging" concerning tourism infrastructure. This pattern reflects a broader nationwide trend, emphasizing the necessity for strategic investments to unlock the latent potential of these inland regions. An additional impediment lies in accessibility challenges. While Aracaju boasts an international airport, venturing into the interior entails navigating winding roads and limiting public transportation options. Notwithstanding these obstacles, Sergipe finds itself at a pivotal juncture. Its landscapes, culture, and authentic experiences hold substantial allure for discerning travelers. Prioritizing accessibility, endorsing responsible development practices, and adeptly showcasing its hidden treasures could herald a transformative chapter in Sergipe's tourism narrative.

#### INTER-REGIONAL INPUT-OUTPUT SYSTEM FOR TOURIST REGIONS, DATABASES, AND INDICATORS

The construction of the interregional system used the *Interregional Input-Output Adjustment System* – IIOAS method, widely employed in the international literature for several countries worldwide. The IIOAS is a hybrid method that blends data provided by official agencies, such as the Brazilian Institute of Geography and Statistics (IBGE), with non-census techniques for estimating unavailable information. The key advantages of IIOAS lie in its alignment with the national input-output matrix data and the flexibility of its regionalization process, which can be applied to any country that publishes its national tables of uses and resources (TRUs) and provides a system of sectoral regionalized information (Haddad et al., 2015). It was already used for Brazil (Haddad et al., 2017), Egypt (Haddad et al., 2016), Greece (Haddad et al., 2020b), Indonesia (Hulu and Hewings, 1993), and Mexico (Haddad et al., 2020a).

The IIOAS method is recommended in contexts where statistical information is limited. Nonetheless, the method demonstrates adherence, consistency, and robust results. In the absence of an official IOM for the state of Sergipe, we use the latest official Brazilian IOM for the base year 2015, which comprises 67 sectors (or industries) and 127 commodities (IBGE, 2018), to generate an interregional system that includes the Sergipe's tourist regions.

The Brazilian IOM is disaggregated according to sectoral production in Sergipe and the rest of Brazil. In other words, input usage, consumption of final goods, and value-added payments in Sergipe are generated as "residuals" from the national economy. This approach allows the construction of a Sergipe-specific matrix with unique characteristics regarding technical coefficients and production multipliers. Furthermore, due to the scarcity of regional information for all activities, it was necessary to reduce the number of sectors to 59, as shown in Appendix 1. Figure 2 summarizes the stages of the IIOAS method.

<Insert Figure 2>

The first column presents the matrices required for constructing the interregional system, i.e., the IO tables of Brazil and the regional shares of production and final demand vectors. From the second column onward, the estimation process stages are depicted. After constructing the regional vectors, the regional trade matrices are estimated based on the following steps:

- (i) Organizing regional shares of production and final demand components using municipal data from the state of Sergipe and the rest of Brazil (see Appendices 2 and 3).
- (ii) Estimating the total supply of each industry by region, excluding exports and stock variation, to obtain the total sales of each commodity in domestic markets, that is:

$$DOM\_Sales_{ix1}^R = GO_{ix1}^R - X_{ix1}^R - SV_{ix1}^R \quad \forall R = 1, \dots, 7$$

$$\forall i = 1, \dots, 59 \quad (1)$$

- (iii) Estimating the total demand for each domestic and imported goods in each region if the demand structure of respective users follows the preference patterns of national demand.

$$DOM\_Dem_{ix1}^R = \sum_{j=1}^{59} IC_{ixj}^{R,DOM} + GFCF_{ixj}^{R,DOM} + HC_{ix1}^{R,DOM} + GE_{ix1}^{R,DOM} \quad \forall i = 1, \dots, 59 \quad (2)$$

$$\forall R = 1, \dots, 7$$

$$IMP\_Dem_{ix1}^R = \sum_{j=1}^{59} IC_{ixj}^{R,IMP} + GFCF_{ix1}^{R,IMP} + HC_{ix1}^{R,IMP} + GE_{ix1}^{R,IMP} \quad \forall i = 1, \dots, 59 \quad (3)$$

$$\forall R = 1, \dots, 7$$

(iv) Estimation of trade matrices representing the transactions of each commodity between origin and destination for each industry (intraregional flows).

The first step in obtaining the SHIN tables is the generation of diagonal cells (interregional submatrices) corresponding to commodity flows using the following equation:

$$SHIN^1_{(c,d,d)} = Min \left\{ \frac{DOM\_Sales_{(c,d)}}{DOM\_Dem_{(c,d)}}, 1 \right\} * F(c) \quad (4)$$

In equation 4,  $c=1, \dots, 59$ , represents a given industry, while  $d=1, \dots, 7$  represents the regions of origin and destination, where in the specific case,  $d = d$  when applied to obtain the diagonal submatrices. The term  $F(c)$  defines the pattern of international trade for goods (sectors), with values closest to 1 indicating non-tradable sectors or "local goods". Table 3 shows the values used. As expected, most non-tradable sectors are service activities.

<Insert Table 3>

In equation 5,  $d=1, \dots, 7$  also represents the origin and destination regions, but for the specific case,  $o \neq d$  is applied to obtain the inter-regional submatrices (inter-regional flows).

$$SHIN^2_{(c,o,d)} = \left\{ \frac{1}{(dist_{(o,d)})^2} \cdot \frac{DOM\_Sales_{(c,o)}}{\sum_{k=1}^7 DOM\_Sales_{(c,k)}} \right\} \left\{ \frac{1 - SHIN_{(c,d,d)}}{\sum_{j=1, j \neq 1}^7 \left[ \frac{1}{(dist_{(j,d)})^2} \cdot \frac{DOM\_Sales_{(c,j)}}{\sum_{k=1}^7 DOM\_Sales_{(c,k)}} \right]} \right\} \quad (5)$$



Table 4 shows the distance matrix ( $dist_{j,d}$ ), which refers to the road distance in kilometers between origin and destination, where the reference point for each region is the municipality with the highest GDP in 2015.

<Insert Table 4>

- (v) The calculation of intraregional and interregional flow matrices ("initial values") between (o, d) is expressed in equations 6 and 7:

$$Trade_1 = SHIN_{(c,d,d)}^1 * DOM\_Dem_{(c,d)} \quad (6)$$

$$Trade_2 = SHIN_{(c,o,d)}^2 * DOM\_Dem_{(c,d)} \quad (7)$$

- (vi) Balancing the trade matrices to equate the supply and demand of each commodity using the bi-proportional adjustment method.

Given that the construction of the inter-regional system requires data from different statistical sources, a system balancing procedure is performed, which was carried out using the bi-proportional adjustment method (RAS), ensuring consistency and balance between supply and demand.

- (vii) Finally, the combination of transactions within and between the different regions of the sample enables the generation of an inter-regional system related to the trade of intermediate goods.

### *Databases*

We obtained information on sectoral production from different municipal data sources. For the agriculture sector, the value of production from temporary and permanent crops is aggregated directly from the Municipal Agricultural Production Survey (PAM) for the year 2015. For the livestock sector, the value of animal production is considered from the Municipal Livestock Survey (PPM) of 2015. For the forestry production sector, the values of production in silviculture and plant extraction are combined from the Plant Extraction Production Survey

(PEVS) in 2015. For the remaining 56 productive sectors, regional shares are measured using the following proxy variables: (i) wages paid to formal workers and (ii) wages paid to formal and informal workers. The choice of proxy variable is made based on the characteristic of each sector, with information from the Annual Employment Information Report (RAIS) for industrial activities and microdata from the 2010 Demographic Census of the Brazilian Institute of Geography and Statistics (IBGE) for the service sectors (see Appendix 2).

A new regional distribution is organized to represent workforce employment in each sector. This new approach allows sectoral employment per production unit to be flexible and not bound to a fixed rate, as established in the 2015 Brazilian IOM. In other words, a given sector employs proportionally depending on the peculiarities of each region. Due to the scarcity of municipal data in primary sector surveys, the employment distribution follows the regional share of production in corresponding activities. We use the number of active employment contracts as of December 31, 2015, available in the RAIS for industrial activities. For service sectors, the total number of employees, both with and without formal contracts, is estimated using microdata from the 2010 Demographic Census.

For government consumption expenditures, we use the participation of each tourist region in the value-added of the public administration in Sergipe. To do this, we aggregate the municipal values provided at the municipality level by IBGE for 2015 (see Appendix 3).

Given the unavailability of other proxy variables at the municipal level, the regional share of the remaining macroeconomic aggregates follows the regional distribution of sectoral production. To do this, we adopted new assumptions that gross capital formation, household consumption, and consumption of nonprofit institutions serving households (NPISH) are proportional to regional production in monetary terms.

The data on foreign trade for tourist regions is obtained from the Federal Government's Comex Stat. In this case, it is necessary to reconcile the commodities classified under the Harmonized

System Code (HS4) with the 127 commodities in the 2015 IOM. The sectoral regionalization is prepared by applying the proportions of each commodity's exports to the weighted values of exports in the matrix. For commodities in the IOM for which data is not available in Comex Stat, the total export value of each commodity is multiplied by the share of each region in total output.

However, the values provided in Comex Stat consider the municipality of the exporting company rather than the municipality of origin of the commodities. For the state of Sergipe, where commodity distribution varies among regions, the use of such data leads to significant distortions in the interregional system. For example, the Polo Costa dos Coqueirais accounted for 89.3% of agricultural exports in 2015 while being responsible for only 15.5% of the state's total output. Considering these issues, the literature suggests relying on the regional distribution of sectoral production.

For the identification of tourism-related activities (TCAs) in Brazil, we use the study "Economia do Turismo - Uma Perspectiva Macroeconômica 2003–2009" (IBGE, 2012). According to this study, TCAs accounted for 3.6% of the country's gross value added in 2003. Moreover, tourism comprises the following activities: i) restaurants and accommodation services, ii) passenger transportation, iii) travel agencies and tour operators, and iv) recreational and entertainment services. Matching this information with the IOM, we identify six TCAs: S34 - Land transportation; S35 - Water transportation; S36 - Air transportation; S38 - Accommodation; S39 - Food services; S57 - Artistic, creative, and entertainment activities; and S50 - Other administrative and support services. The last activity includes Travel Agencies.

However, given the absence of a Tourism Satellite Account in Brazil and Sergipe, using these sectors directly without any statistical treatment would overestimate the weight of tourism activities in the economy. Thus, it is necessary to disaggregate these sectors' Tourism Characteristic Activities (TCAs). Based on information from the wage mass of RAIS,

Gonçalves et al. (2020) constructed weights for the disaggregation of TCAs in Brazil. According to these authors, the weights had low variability between 2010 and 2015. For the state of Sergipe, the Institute of Applied Economic Research (IPEA) provided monthly sectoral weights for 2015, as shown in Table 5.

<Insert Table 5>

Due to minor weight variations throughout 2015, we consider the weight for December. It can be observed that Air transportation, Accommodation, and Travel agencies have the highest weights, with 95%, 86%, and 83%, respectively, of these sectors corresponding to tourism activities. On the other hand, sectors such as Culture and leisure, Food Services, and Non-metropolitan land transportation have the lowest weights. The Water transportation sector will not be considered as its weight in Sergipe was zero. Based on these weights, the trade flows of the corresponding sectors in the IOM were disaggregated. Thus, the matrix now recognizes six additional tourism sectors: Tourist land transportation, Tourist air transportation, Tourist accommodation, Tourist food services, Professional tourist services (travel agencies), and Artistic, creative, and entertainment tourist activities (culture and leisure). The analyses in the results section will refer to these activities.

### *Indicators*

To structurally evaluate the TCAs in the tourist regions of Sergipe, we calculate the simple production and employment multipliers and the backward-forward indexes. To define these indices, the starting point is the solution of the IO model, formally expressed as:

$$x = (I - A)^{-1}y \quad (8)$$

Where  $x$  is the output vector,  $L = (I - A)^{-1}$  is the Leontief Inverse matrix, and  $y$  is the final demand vector. The simple production and employment multiplier of sector  $j$  can be defined,

respectively, as  $m(o)_j \sum_{i=1}^n l_{ij}$  and  $m(h)_j \sum_{i=1}^n a_{n+1, i} l_{ij}$ , in which  $a_{n+1}$  is the employment coefficient, that is, the ratio between employment and the output in sector  $j$ .

Rasmussen's (1956) and Hirschman's (1958) indices measure the degree of backward and forward linkages of a given productive structure. The indices are expressed by a ratio between the average of the impacts of the sector and the total average of the economy, that is:

$$U_{oj} = \frac{\frac{1}{n} L_{oj}}{\frac{1}{n^2} \sum_{i=1}^n L_{oj}}$$

(9)

$$U_{io} = \frac{\frac{1}{n} L_{io}}{\frac{1}{n^2} \sum_{j=1}^m L_{io}}$$

(10)

where  $U_{oj}$  is the backward linkage (BL), and  $U_{io}$  is the forward linkage (FL). The sector is considered a key sector when it presents both indices above one and, therefore, when it has intermediate purchases and sales above the economy average.

## RESULTS AND DISCUSSION

The first three tables provide an exploratory analysis of the inter-regional system to assess the generation of value-added and the regional composition of trade flows between the tourist regions of Sergipe. We estimated that tourist activities accounted for only 1.53% of the state GVA in 2015. IPEA estimated the weight of tourism in the Northeast region and Brazil at 2.1% and 2.2%, respectively, considering occupation data in December 2014. When considering wages in the formal labor market, Gonçalves et al. (2020) estimated at 3.02% the weight of TCAs in the total GVA of Sergipe in 2015. Without the disaggregation of TCAs from the coefficients shown in Table 5, the weight of the “tourism sector” in the total GVA of Sergipe would be overestimated by 3.7 times, that is, 5.6%.

Table 6 presents the GVA distribution of the TCAs in Sergipe's tourist regions. We can see an intense concentration in the Polo Costa dos Coqueirais, which accounts, on average, for 83.2% of the value-added generation of TCAs within the state of Sergipe. Except for the Polo Costa dos Coqueirais, the GVA for Tourist land transportation has a more homogeneous distribution

among the other tourist regions. The only airport in Sergipe is in the capital, Aracaju, which explains the generation of 100% of GVA for Tourist air transportation in the Polo Costa dos Coqueirais.

<Insert Table 6>

Tables 7 and 8 show the share of trade flows among the tourist regions of Sergipe, the rest of Sergipe, and the rest of Brazil based on the origin of purchases and destination of intermediary sales, respectively. We highlighted the intra-regional flows on the main diagonal: purchases and sales made within the region.

<Insert Table 7>

The Polo dos Tabuleiros and the Polo Costa dos Coqueirais have the highest degree of self-sufficiency among the tourist regions of Sergipe since 14.7% and 12.7% of their purchases and 17% and 12.3% of their sales, respectively, have region itself as origin and destination (see Table 7). Sergipe is the smallest state in Brazil, so we can see the substantial importance that the rest of Brazil has in the composition of trade flows for all the tourist regions in the state.

The origin of purchases from the other tourist regions (R2 to R5), except for those originating in the region itself, is greater in the Polo Costa dos Coqueirais than the sum of purchases originating in the other regions of Sergipe. The Polo Velho Chico (92.5%) and the Polo Sertão das Águas (90%) have the greatest dependence on the rest of Brazil about the origin of their purchases.

The relative importance within the state of Sergipe of the Polo Costa dos Coqueirais also appears in the sales' destination, as shown in Table 8. The Polo Tabuleiros is the tourist region that proportionally sells fewer inputs and goods to the rest of Brazil, whose region accounts for 59.6% of the destination of its intermediary sales.

<Insert Table 8>

Table 9 presents the simple production multipliers by TCA and tourist regions in Sergipe. As it is an inter-regional system, these multipliers are broken down into intra (region itself), inter (spillover effect), and total (sum of the two previous ones). The last row of the table shows the regional multipliers, which consider all economic sectors per region. A significant advantage of these multipliers is the possibility of explicitly measuring the spillover effect to other regions, which can help in elaborating and implementing tourism policies in Sergipe with a focus on regional production chains. Moreover, Fleischer and Freeman (1997) warn about the importance of considering the interactions of multiregional models not to underestimate the multiplier effects of tourism.

<Insert Table 9>

The highest regional production multipliers are from the Polo dos Tabuleiros and the Polo Costa dos Coqueirais. For the first one, for every variation of \$1 in its final demand, the entire economy would generate \$1.68, with \$1.06 in the region itself, and \$0.63 would leak to other regions. The lowest regional leakage effect is from the Polo Serras Sergipanas (0.57) and the highest from the Polo Sertão das Águas (0.64).

From the sectoral point of view, the interregional multipliers differ more among Sergipe's tourist regions when compared to the total multipliers, which are more similar across regions. For instance, the simple production multiplier of Tourist land transportation varies between 1.94 and 1.99 between tourist regions. It means that for each variation of \$ 1 in its final demand, the economy would produce between \$ 1.94 and \$ 1.99 depending on the region considered. However, the spillover effect (inter multiplier) varies between 0.88 and 0.97. For each variation of \$ 1 in the final demand of Tourist land transportation in Polo dos Tabuleiros, for instance, the entire economy would have to produce \$ 1.98 to meet this variation, with \$ 1.09 being produced in the region itself and \$ 0.90 would be leaked to other regions.

The highest total production multiplier in all tourist regions, including the above regional multiplier, is the Tourist air transportation, with values ranging between 2.07 and 2.15. However, in all tourist regions, this sector has a strong spillover effect (inter). For Polo Velho Chico, for example, for every \$ 1 variation in the final demand of this sector, the entire economy would need to produce \$ 2.15, but only \$ 1.01 would be in the locality itself, and \$ 1.14 would leak to other regions. According to Souza et al. (2015), the tourism sector had a production multiplier 1.31 in the Brazilian Northeast.

Table 10 presents the simple employment multipliers by TCA and tourist region in Sergipe. The last row of the table shows the regional multipliers, which consider all economic sectors. Generally, there is greater regional variability in the total multiplier and a smaller one in the inter-regional employment multiplier. Furthermore, the spillover effect (inter) is low in all ACTs in all tourist regions since the activity is developed locally. Ribeiro et al. (2017) pointed out a similar result when estimating the impact of tourist spending in the Brazilian Northeast. These authors observed a low effect of job leakage outside the region. These results highlight the comparative advantage of tourism in the Brazilian Northeast, driven by the region's natural resources and development potential, as corroborated by Ribeiro et al. (2022).

The highest employment multiplier among the TCAs is that of Artistic, creative, and touristic entertainment activities, varying between 40 and 89 among the tourist regions, even well above the regional multipliers. This means that, for every \$ 1 million variation in the final demand of this sector, between 40 and 89 jobs would be created directly and indirectly depending on the region. For each variation of R\$ 1 million in the final demand of this sector in Polo Velho Chico, for instance, 89 jobs would be created throughout the economy, 84 of which would be in the region itself, and 4 jobs would spillover to other regions.

<Insert Table 10>



Except for the Polo Costa dos Coqueirais, the employment multiplier of Tourist air transportation is zero in all tourist regions. This means that all jobs generated due to variations in the final demand of this sector would be generated outside the respective regions. This result is consistent with what has already been shown in Table 6. The employment multiplier of Tourist food services is also relevant across regions. Its spillover effect of Polo Velho Chico is slightly higher than the economy average. According to Souza et al. (2015), the main activities that contributed to the generation of employment in the Brazilian Northeast were Accommodation, road transportation of passengers, and food services.

Only Tourist air transportation and Professional tourist services have shown employment multipliers smaller than the regional multiplier (considering all economic sectors) in all the tourist regions, except for the last sector in Polo Sertão das Águas.

Table 11 presents the results of the Hirschman-Rasmussen (HR) indices by TCA and Sergipe's tourist regions. We have highlighted in red and blue, respectively, the above-average forward and backward linkages. Tourist land transportation is the only TCA ranked as a key sector across all tourist regions, i.e., both indices above one. Prado (1981) and Guilhoto et al. (2005) state that key sectors should be considered strategic to stimulate economic growth. A similar result for the Brazilian capital (Federal District) was found by Takasago and Mollo (2011). They identified that the road transportation and intercity tourism sector was also considered a key sector along with the recreational and cultural activities sector.

In general, backward linkages are greater than forward linkages, which means that tourism activities buy more inputs from other sectors than they sell. This result is expected and consistent with previous studies carried out for Bermuda (Archer, 1995), Seychelles (Archer and Fletcher, 1996), China (Oosterhaven and Fan, 2006), East Asia (Blake, 2008), Brazil (Takasago et al., 2010), South Korea (Lee and Hlee, 2021) and Indonesia (Kumara et al., 2021). This occurs because tourist activities mostly meet final demand.

The Tourist accommodation sector, according to Miller and Blair (2022) can be classified as dependent on inter-industry supply as it only presents purchases above the average for the economy ( $BL > 1$ ) in all tourist regions, except Polo dos Tabuleiros. Most tourist activities are not strongly connected with other sectors since their intermediate purchases and sales are below average ( $BL$  and  $FL < 1$ ). Gabriel et al. (2020) state that industrial segments are more expected to be classified as key sectors since they purchase and sell a greater diversity of activities. An example of this for the state of Sergipe is that the four key sectors, according to Ribeiro and Leite (2012), are industrial: Food and beverages, Textiles, Paper and cellulose, and Rubber and plastic.

<Insert Table 11>

For Brazil, Casimiro Filho and Guilhoto (2003) identified six key sectors of the tourism segment: air transportation, travel agencies, auxiliary activities to air transportation, Accommodation, restaurants, and other food service establishments. It is noteworthy, however, that these authors did not perform any statistical treatment regarding the weight of the TCAs. Our findings offer significant socioeconomic insights for Sergipe, and it can serve as a case study for all Brazilian states and similar regions worldwide. Identifying key sectors within the tourism industry, characterized by high economic multipliers, presents an opportunity to bolster economic development. In addition, we highlight the regional dynamics of tourism activities. By acknowledging and leveraging the distinct economic contributions of different regions, regional policies can work towards reducing disparities and promoting more inclusive development.

Understanding employment multipliers across various tourism activities provides a valuable tool for crafting labor market policies. Policymakers can prioritize sectors with higher job creation potential, contributing to local and regional employment opportunities. Furthermore, the study's insights into income generation and inequality highlight the potential of tourism to

play a role in addressing socioeconomic disparities. Crafting targeted policies that harness the economic benefits of tourism can contribute to reducing income inequality and enhancing overall economic well-being across the state.

## CONCLUSIONS

This research advances the estimation of an inter-regional IO system specified for tourist regions in Sergipe and disaggregates the tourism activities. However, the ideal scenario is the Brazilian statistical officers' availability of the Tourism Satellite Accounts. Thus, the impacts of these activities can be estimated more precisely since, in tourist activities, only what is consumed by tourists will be considered.

The exploratory analysis revealed that TCAs accounted for only 1.53% of Sergipe's state GVA in 2015. Comparatively, the weight of tourism in the Northeast and Brazil was estimated at 2.1% and 2.2%, respectively. Furthermore, without disaggregating the TCAs from the presented coefficients, the weight of the tourism sector would be overestimated 3.7 times.

The Polo Costa dos Coqueirais was identified as the region concentrating the largest generation of GVA from the TCAs in Sergipe, corresponding to 83.2% of the state's total. Furthermore, Tourist air transportation had the highest production multiplier, varying between 2.07 and 2.15 in all regions. However, tourist regions also showed a strong spillover effect, indicating that part of the generated production is destined for other regions. As for employment multipliers, artistic and creative activities and tourist shows had the highest values. The spillover effect of jobs to other regions was low in all TCAs and tourist regions, indicating that the activity is predominantly developed locally.

Tourist land transportation was a key sector in all tourist regions of Sergipe. In general, backward linkage indices were higher than forward linkage indices, indicating that TCAs purchase more inputs from other sectors than they sell. Tourist activities would mainly meet the

final demand. The Tourist accommodation sector depended on inter-industry supply, with purchases above the average in all regions except for the Polo dos Tabuleiros. Most tourist activities are not strongly connected to other sectors, as their intermediate purchases and sales are below average for the economy.

We used an unprecedented method in the Brazilian literature that disaggregates tourist activities by sector and region. In addition, with the identification of TCAs in Sergipe, it was possible to measure the spillover effect to other regions explicitly. It can be useful for elaborating and implementing tourism policies focused on regional production chains. Furthermore, researchers can replicate this method for countries and regions that, like Brazil, do not have a Tourism Satellite Account.

The main limitation of the research, however, is that the technical coefficients of disaggregated tourist activities, for example, tourist accommodation and non-tourist Accommodation, are the same. Ideally, we would have specific coefficients for each tourism sub-activity, which is only possible with the Satellite Account.

The utilization of disaggregated data from this study offers a concrete foundation for crafting targeted policies and interventions in Sergipe's tourism sector. With a detailed understanding of various TCAs' specific contributions and regional distribution, stakeholders can tailor strategies to each tourist region's unique needs and potential. This granularity in data analysis becomes instrumental for optimizing resource allocation, fostering economic growth, and a practical approach to tourism planning.

Addressing regional development disparities is imperative, as the study reveals the concentration of tourism-related economic activities. Actionable measures such as strategic infrastructure improvements, direct support for local entrepreneurial ventures, and targeted promotion of distinctive attractions must be implemented to stimulate economic growth in less-developed tourism regions. These interventions should spur economic development, reduce

regional inequalities, and cultivate a more diversified and equitable tourism landscape in Sergipe. Sustainable practices are critical nowadays, emphasizing the necessity for responsible tourism development that safeguards the local natural and cultural heritage. Specific measures could involve implementing stringent environmental regulations, community engagement initiatives, and promoting eco-friendly tourism practices.

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Table 1: Tourist regions of Sergipe, 2022

<b>Polo Costa dos Coqueirais (10)</b>	<b>ID</b>	<b>Polo Sertão das Águas (8)</b>	<b>ID</b>
Aracaju	A	Boquim	D
Barra dos Coqueiros	C	Cristinápolis	D
Estância	C	Itabaianinha	D
Indiaroba	E	Lagarto	C
Itaporanga d'Ajuda	D	Salgado	D
Nossa Senhora do Socorro	C	Tobias Barreto	C
Pacatuba	D	Tomar do Geru	D
Pirambu	D	Umbaúba	D
Santa Luzia do Itanhy	E	<b>Polo Velho Chico (11)</b>	
São Cristóvão	D	Canindé de São Francisco	D
<b>Polo dos Tabuleiros (11)</b>		Cedro de São João	D
Aquidabã	D	Gararu	D
Capela	D	Monte Alegre de Sergipe	D
Carmópolis	D	Nossa Senhora da Glória	D
Cumbe	E	Nossa Senhora de Lourdes	D
Divina Pastora	E	Poço Redondo	D
Maruim	E	Porto da Folha	D
Muribeca	E	Propriá	C
Nossa Senhora das Dores	D	Santana do São Francisco	E
Riachuelo	E	Telha	D
Santa Rosa de Lima	E		
Siriri	D		
<b>Polo Serras Sergipanas (5)</b>			
Areia Branca	E		
Frei Paulo	D		
Itabaiana	C		
Moita Bonita	E		
Ribeirópolis	E		

Source: Brasil (2022). Author's own.

Table 2: Indicators of the Sergipe's tourist regions, 2020<sup>1</sup>

<b>Tourist regions</b>	<b>Population<sup>2</sup> (%)</b>	<b>GDP<sup>3</sup> (%)</b>	<b>GDP per capita (R\$)</b>
Polo Costa dos Coqueirais	48.86	54.88	21,995
Polo dos Tabuleiros	6.78	5.19	15,000
Polos Serras Sergipanas	6.92	6.59	18,654
Polo Sertão das Águas	13.11	8.64	12,908
Polo Velho Chico	9.12	12.46	26,750
Rest of Sergipe	15.20	12.23	15,755

Source: <sup>(1)</sup> Most recent year available for GDP data. <sup>(2)</sup> Population estimates for 2020, IBGE. <sup>(3)</sup> System of National Accounts, IBGE. Author's own.

Table 3: Value of the term F(c) for the sectors of the IOM, 2015.

Type	Criterion	F(c)	Sectors (No.)
<i>Tradable</i>	$\frac{DOM\_Sales_c}{GO_c} \leq 0.99$	0.5	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 33, 35, 36, 37, 38, 39, 40, 41, 43, 44, 46, 47, 48, 49, 50, 57
<i>Non-tradable</i>	$\frac{DOM\_Sales_c}{GO_c} > 0.99$	0.9	14, 30, 31, 32, 34, 42, 45, 51, 52, 53, 54, 55, 56, 58, 59

Source: Author's own.

Table 4: Distance matrix (in km) between the regions of the interregional system, 2015

Code	Region name	Reference point (city)	Region code						
			R1	R2	R3	R4	R5	R6	R7
R1	Polo Costa dos Coqueirais	Aracaju	0.0	48.6	55.8	79.3	196	38.8	2,161
R2	Polo dos Tabuleiros	Carmópolis	49.6	0.0	73.6	110	160	12.7	2,191
R3	Polo Serras Sergipanas	Itabaiana	56.3	73.4	0.0	40	140	62.3	2,164
R4	Polo Sertão das Águas	Lagarto	79.9	111	41.1	0.0	179	101	2,124
R5	Polo Velho Chico	Canindé São Francisco	195	160	141.0	179	0.0	158	2,237
R6	Rest of Sergipe	Rosário do Catete	39	12.4	61.7	99.4	158	0.0	2,181
R7	Rest of Brasil	São Paulo	2,156	2,187	2,159	2,120	2,232	2,177	0.0

Source: Author's own based on information from Google Maps.

Table 5: Weight for the disaggregation of TCAs in Sergipe, December 2015

TCAs	Sergipe	Brazil
Food services	0.22	0.27
Water transportation	0.00	0.10
Air transportation	0.95	0.83
Travel agencies	0.83	0.78
Culture and leisure	0.15	0.04
Accommodation	0.86	0.78
Non-metropolitan land transportation	0.21	0.26

Source: IPEA.

Table 6: GVA regional distribution of TCAs in Sergipe, 2015

Tourist activities	Polo Costa dos Coqueirais	Polo dos Tabuleiros	Polo Serras Sergipanas	Polo Sertão das Águas	Polo Velho Chico	Resto de Sergipe
Tourist land transportation	69.1%	6.5%	7.1%	6.7%	4.6%	6%
Tourist air transportation	100%	0%	0%	0%	0%	0%
Tourist accommodation	83.6%	1.1%	0.9%	2.8%	7.9%	3.7%
Tourist food services	76.9%	1.7%	6.4%	6.9%	3.3%	4.7%
Professional tourist services	91.3%	0.2%	4.2%	0.9%	2.7%	0.7%
Artistic, creative, and tourist entertainment activities	78.1%	0.8%	4.6%	7.5%	2.7%	6.3%

Source: Author's own based on IOM.

Table 7: Share of the origin of trade flows by tourist region of Sergipe, 2015

<b>Regions</b>	<b>R1</b>	<b>R2</b>	<b>R3</b>	<b>R4</b>	<b>R5</b>	<b>R6</b>	<b>R7</b>
R1 Polo Costa dos Coqueirais	12.7%	6.8%	7.0%	3.5%	0.8%	12.2%	0.4%
R2 Polo dos Tabuleiros	0.3%	14.7%	0.1%	0.0%	0.0%	3.4%	0.0%
R3 Polo Serras Sergipanas	0.2%	0.1%	9.4%	0.6%	0.1%	0.2%	0.0%
R4 Polo Sertão das Águas	0.2%	0.1%	0.7%	5.6%	0.1%	0.1%	0.0%
R5 Polo Velho Chico	0.0%	0.1%	0.1%	0.1%	6.4%	0.0%	0.0%
R6 Rest of Sergipe	4.1%	6.2%	0.5%	0.3%	0.1%	7.6%	0.1%
R7 Rest of Brazil	82.5%	72.0%	82.2%	90.0%	92.5%	76.5%	99.4%
Total	100%	100%	100%	100%	100%	100%	100%

Source: Author's own based on IOM.



Table 8: Share of the trade flows' destination by tourist region of Sergipe, 2015

<b>Regions</b>	<b>R1</b>	<b>R2</b>	<b>R3</b>	<b>R4</b>	<b>R5</b>	<b>R6</b>	<b>R7</b>	<b>Total</b>
R1 Polo Costa dos Coqueirais	12.3%	0.3%	0.3%	0.3%	0.1%	1.9%	84.9%	100%
R2 Polo dos Tabuleiros	8.0%	17.0%	0.1%	0.1%	0.1%	15.2%	59.6%	100%
R3 Polo Serras Sergipanas	5.0%	0.1%	9.5%	1.0%	0.1%	0.6%	83.8%	100%
R4 Polo Sertão das Águas	2.4%	0.1%	0.5%	6.6%	0.1%	0.3%	90.1%	100%
R5 Polo Velho Chico	0.5%	0.0%	0.1%	0.1%	6.3%	0.1%	92.9%	100%
R6 Rest of Sergipe	20.4%	1.3%	0.1%	0.1%	0.0%	6.1%	71.9%	100%
R7 Rest of Brazil	0.4%	0.0%	0.0%	0.0%	0.0%	0.1%	99.4%	100%

Source: Author's own based on IOM.

Table 9: Production multiplier by tourist activity and tourist region of Sergipe, 2015

Tourist activities	Polo Costa dos Coqueirais			Polo dos Tabuleiros			Polo Serras Sergipanas			Polo Sertão das Águas			Polo Velho Chico			Rest of Sergipe		
	Intra	Inter	Total	Intra	Inter	Total	Intra	Inter	Total	Intra	Inter	Total	Intra	Inter	Total	Intra	Inter	Total
Tourist land transportation	1,07	0,88	1,95	1,09	0,90	1,98	1,08	0,91	1,99	1,04	0,94	1,99	1,02	0,97	1,99	1,04	0,91	1,94
Tourist air transportation	1,03	1,06	2,09	1,03	1,09	2,12	1,02	1,12	2,13	1,01	1,12	2,14	1,01	1,14	2,15	1,02	1,05	2,07
Tourist accommodation	1,06	0,64	1,70	1,05	0,66	1,71	1,04	0,67	1,70	1,02	0,68	1,70	1,04	0,67	1,70	1,03	0,67	1,70
Tourist food services	1,03	0,83	1,85	1,03	0,83	1,87	1,03	0,83	1,86	1,02	0,84	1,86	1,01	0,86	1,87	1,02	0,84	1,86
Professional tourist services	1,02	0,96	1,98	1,03	0,93	1,96	1,02	0,96	1,98	1,01	0,94	1,95	1,01	0,99	2,00	1,03	0,95	1,97
Artistic, creative, and tourist entertainment activities	1,04	0,55	1,60	1,02	0,58	1,60	1,02	0,58	1,60	1,01	0,59	1,60	1,02	0,58	1,60	1,01	0,58	1,60
<b>Regional multipliers</b>	<b>1,06</b>	<b>0,63</b>	<b>1,68</b>	<b>1,06</b>	<b>0,62</b>	<b>1,69</b>	<b>1,04</b>	<b>0,57</b>	<b>1,61</b>	<b>1,02</b>	<b>0,64</b>	<b>1,67</b>	<b>1,02</b>	<b>0,58</b>	<b>1,60</b>	<b>1,03</b>	<b>0,65</b>	<b>1,68</b>

Source: Author's own based on IOM.

Table 10: Employment multiplier by tourist activity and tourist region of Sergipe, 2015

Tourist activities	Polo Costa dos Coqueirais			Polo dos Tabuleiros			Polo Serras Sergipanas			Polo Sertão das Águas			Polo Velho Chico			Rest of Sergipe		
	Intra	Inter	Total	Intra	Inter	Total	Intra	Inter	Total	Intra	Inter	Total	Intra	Inter	Total	Intra	Inter	Total
Tourist land transportation	16	5	21	16	5	21	22	5	27	27	5	32	26	5	31	26	5	31
Tourist air transportation	3	6	9	0	6	6	0	6	6	0	6	6	0	7	7	0	6	6
Tourist accommodation	17	6	23	22	6	28	40	6	46	32	6	38	22	6	28	28	6	34
Tourist food services	24	7	31	45	7	52	28	7	35	38	7	45	50	8	58	54	7	61
Professional tourist services	7	7	14	11	7	18	9	7	16	24	7	31	8	7	15	29	7	36
Artistic, creative, and tourist entertainment activities	36	4	40	64	4	68	60	4	64	80	4	84	84	4	88	87	4	91
<b>Regional multipliers</b>	<b>9</b>	<b>6</b>	<b>16</b>	<b>13</b>	<b>6</b>	<b>19</b>	<b>15</b>	<b>6</b>	<b>21</b>	<b>13</b>	<b>6</b>	<b>20</b>	<b>18</b>	<b>6</b>	<b>23</b>	<b>9</b>	<b>6</b>	<b>15</b>

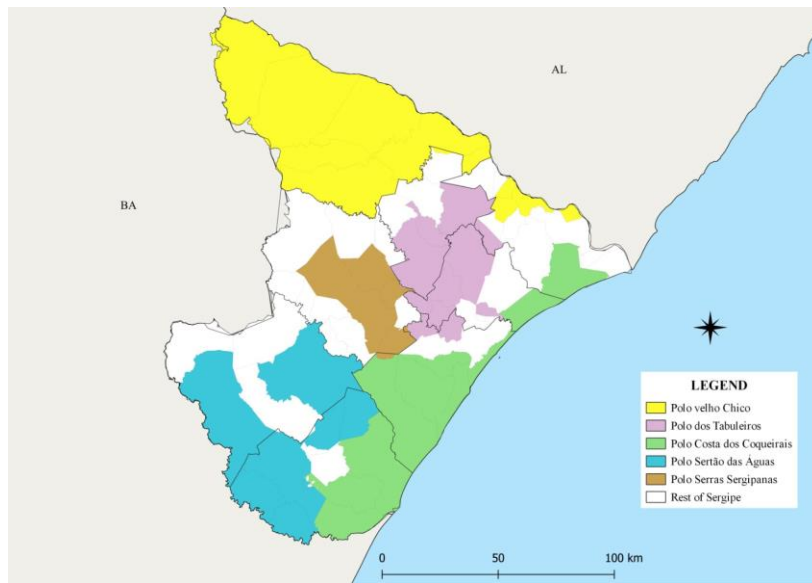
Source: Author's own based on IOM.

Table 11: HR indexes of tourist activity by tourist region of Sergipe, 2015

Tourist activities	Polo Costa dos Coqueirais		Polo dos Tabuleiros		Polo Serras Sergipanas		Polo Sertão das Águas		Polo Velho Chico		Rest of Sergipe	
	BL	FL	BL	FL	BL	FL	BL	FL	BL	FL	BL	FL
Tourist land transportation	<b>1,023</b>	<b>1,136</b>	<b>1,035</b>	<b>1,209</b>	<b>1,040</b>	<b>1,202</b>	<b>1,022</b>	<b>1,116</b>	<b>1,003</b>	<b>1,044</b>	<b>1,010</b>	<b>1,044</b>
Tourist air transportation	0,982	0,956	0,978	0,951	0,981	0,965	0,990	0,978	0,986	0,980	0,993	0,972
Tourist accommodation	<b>1,012</b>	0,958	0,995	0,953	<b>1,000</b>	0,966	<b>1,003</b>	0,980	<b>1,016</b>	0,982	0,997	0,975
Tourist food services	0,983	0,957	0,982	0,952	0,989	0,968	0,996	0,980	0,992	0,981	0,989	0,973
Professional tourist services	0,975	0,958	0,978	0,951	0,988	0,966	0,991	0,978	0,987	0,981	0,999	0,972
Artistic, creative, and tourist entertainment activities	0,997	0,956	0,974	0,951	0,983	0,965	0,992	0,979	<b>1,000</b>	0,980	0,985	0,972

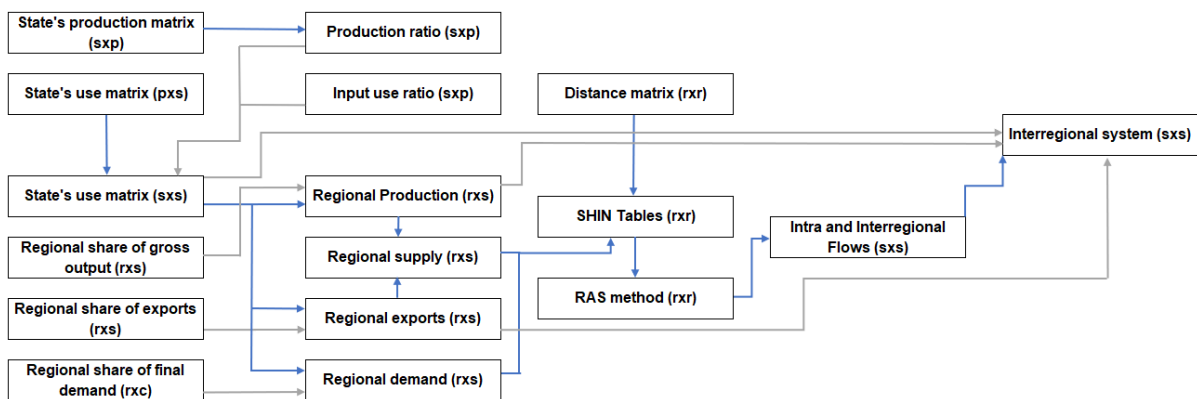
Source: Author's own based on IOM.

Figure 1: Touristic regions of Sergipe



Source: Author's own.

Figure 2: Steps of the IIOAS method



Source: Author's own.

### Appendix 1: Sectoral aggregation

Code	Sector's name	Number	New name
1800	Printing and reproduction of recordings	18	Manufacture of furniture and various industries
3180	Manufacture of furniture and products from various industries		
2091	Manufacture of organic and inorganic chemicals, resins, and elastomers	21	Chemical manufacturing
2092	Manufacture of pesticides, disinfectants, paints, and various chemicals		
2093	Manufacture of cleaning products, cosmetics/perfumes, and personal hygiene items		
2100	Manufacture of pharminochemical and pharmaceutical products		
2500	Manufacture of metal products, excluding machinery and equipment	26	Manufacture of metal products, machinery, and equipment
2600	Manufacture of computer equipment, electronic products, and optical devices		
2700	Manufacture of electrical machinery and equipment		
2800	Manufacture of mechanical machinery and equipment		
3300	Maintenance, repair, and installation of machinery and equipment		

Source: Own elaboration based on information from IBGE, 2016; IBGE, 2011

## Appendix 2: Regional share in the sectoral production of Sergipe, 2015

No.	Sector name	R1	R2	R3	R4	R5	R6	R7
1	Agriculture, including support for agriculture and post-harvest activities	0.001	0.000	0.000	0.001	0.001	0.001	0.996
2	Livestock farming, including support for livestock farming	0.001	0.001	0.001	0.001	0.005	0.002	0.990
3	Forestry production; fishing and aquaculture	0.000	0.000	0.000	0.000	0.000	0.000	1.000
4	Extraction of coal and non-metallic minerals	0.003	0.001	0.001	0.001	0.000	0.019	0.975
5	Extraction of oil and gas, including support activities	0.021	0.001	0.000	0.000	0.000	0.018	0.961
6	Extraction of iron ore, including beneficiation and agglomeration	0.000	0.000	0.000	0.000	0.000	0.000	1.000
7	Extraction of non-ferrous metallic minerals, including beneficiation	0.000	0.000	0.000	0.000	0.000	0.000	1.000
8	Slaughtering and meat products, including dairy and fish products	0.000	0.000	0.000	0.000	0.001	0.000	0.999
9	Sugar manufacturing and refining	0.006	0.000	0.000	0.000	0.000	0.000	0.994
10	Other food products	0.006	0.000	0.000	0.002	0.000	0.000	0.992
11	Beverage manufacturing	0.005	0.000	0.000	0.000	0.000	0.000	0.994
12	Tobacco product manufacturing	0.001	0.000	0.000	0.009	0.000	0.000	0.990
13	Textile manufacturing	0.007	0.000	0.001	0.000	0.001	0.003	0.988
14	Apparel and accessory manufacturing	0.002	0.000	0.000	0.000	0.000	0.000	0.997
15	Footwear and leather goods manufacturing	0.000	0.000	0.000	0.005	0.000	0.005	0.990
16	Wood product manufacturing	0.001	0.000	0.001	0.000	0.000	0.000	0.998
17	Pulp, paper, and paper product manufacturing	0.001	0.000	0.000	0.000	0.000	0.000	0.999
18	Manufacture of furniture and various industries	0.002	0.000	0.001	0.000	0.000	0.000	0.996
19	Petroleum refining and coke ovens	0.015	0.000	0.000	0.000	0.000	0.000	0.985
20	Biofuel manufacturing	0.000	0.002	0.000	0.000	0.000	0.012	0.986
21	Chemical manufacturing	0.005	0.000	0.000	0.000	0.000	0.000	0.994
22	Rubber and plastic product manufacturing	0.001	0.000	0.000	0.001	0.000	0.000	0.999
23	Non-metallic mineral product manufacturing	0.006	0.000	0.002	0.002	0.000	0.000	0.989
24	Pig iron/ferroalloy production, steelmaking, and seamless steel tubes	0.000	0.000	0.000	0.000	0.000	0.000	1.000
25	Non-ferrous metal metallurgy and metal casting	0.000	0.000	0.000	0.000	0.000	0.000	1.000
26	Manufacture of metal products, machinery, and equipment	0.001	0.000	0.000	0.000	0.000	0.000	0.999
27	Manufacture of automobiles, trucks, and buses, except parts	0.000	0.000	0.000	0.000	0.000	0.000	1.000
28	Manufacture of parts and accessories for motor vehicles	0.004	0.000	0.000	0.000	0.000	0.000	0.996
29	Manufacture of other transport equipment, except motor vehicles	0.000	0.000	0.000	0.000	0.000	0.000	1.000
30	Electricity, natural gas, and other utilities	0.006	0.000	0.000	0.000	0.001	0.000	0.993
31	Water, sewage, and waste management	0.010	0.000	0.000	0.001	0.001	0.001	0.987
32	Construction	0.007	0.001	0.000	0.000	0.000	0.000	0.992
33	Wholesale and retail trade	0.004	0.000	0.001	0.001	0.000	0.001	0.993
34	Land transport	0.005	0.000	0.000	0.000	0.000	0.000	0.993
35	Water transport	0.005	0.000	0.000	0.000	0.000	0.000	0.994
36	Air transport	0.002	0.000	0.000	0.000	0.000	0.000	0.998
37	Storage, support activities for transportation, and postal services	0.003	0.000	0.000	0.000	0.000	0.000	0.996
38	Accommodation	0.007	0.000	0.000	0.000	0.001	0.000	0.992
39	Food services	0.005	0.000	0.000	0.000	0.000	0.000	0.993
40	Publishing and integrated printing	0.003	0.000	0.000	0.000	0.000	0.000	0.997
41	Television, radio, film, and sound and image recording/editing activities	0.004	0.000	0.000	0.000	0.000	0.000	0.996
42	Telecommunications	0.002	0.000	0.000	0.000	0.000	0.000	0.997
43	Systems development and other information services	0.002	0.000	0.000	0.000	0.000	0.000	0.998
44	Financial intermediation, insurance, and pension funds	0.004	0.000	0.000	0.000	0.000	0.000	0.994
45	Real estate activities	0.004	0.000	0.000	0.000	0.000	0.000	0.996
46	Legal, accounting, consulting, and corporate head offices	0.004	0.000	0.000	0.000	0.000	0.000	0.995
47	Architecture, engineering, technical testing/analysis, and R&D services	0.002	0.000	0.000	0.000	0.000	0.000	0.997
48	Other professional, scientific, and technical activities	0.002	0.000	0.000	0.000	0.000	0.000	0.997
49	Non-real estate rentals and management of intellectual property assets	0.009	0.001	0.000	0.000	0.000	0.000	0.989
50	Other administrative and support services	0.004	0.000	0.000	0.000	0.000	0.000	0.995
51	Surveillance, security, and investigation activities	0.006	0.000	0.000	0.000	0.000	0.000	0.993
52	Public administration, defense, and social security	0.009	0.000	0.000	0.001	0.001	0.001	0.988
53	Public Education	0.006	0.000	0.001	0.001	0.001	0.001	0.990
54	Private education	0.006	0.000	0.000	0.000	0.001	0.001	0.992
55	Public healthcare	0.005	0.000	0.000	0.000	0.001	0.000	0.994
56	Private healthcare	0.005	0.000	0.000	0.000	0.000	0.000	0.994
57	Artistic, creative, and entertainment activities	0.004	0.000	0.000	0.000	0.000	0.000	0.995
58	Associations and other personal services	0.004	0.000	0.000	0.000	0.000	0.000	0.994
59	Domestic services	0.005	0.000	0.000	0.000	0.000	0.000	0.993

Source: Own elaboration.

### Appendix 3: Regional share of final demand components of Sergipe, 2015

Code	Region name	Household consumption (HC)	Gross fixed capital formation (GFCF)	Government Expenditure (GE)	NPISH demand
R1	Polo Costa dos Coqueirais	0.0040	0.0040	0.0051	0.0040
R2	Polo dos Tabuleiros	0.0003	0.0003	0.0006	0.0003
R3	Polo Serras Sergipanas	0.0004	0.0004	0.0007	0.0004
R4	Polo Sertão das Águas	0.0006	0.0006	0.0014	0.0006
R5	Polo Velho Chico	0.0006	0.0006	0.0013	0.0006
R6	Rest of Sergipe	0.0008	0.0008	0.0017	0.0008
R7	Rest of Brazil	0.9933	0.9933	0.9892	0.9933
Total		0.0040	0.0040	0.0051	0.0040

Source: Own elaboration.