Spatial analysis of tourist dispersal and mobility for tourism destination planning and development: A case study of great ocean road region, Australia

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Abstract. Many studies encourage tourist destinations to consider dispersal and mobility as key strategic components of tourism planning and development. Essential aspects such as the visited destinations and the arrival as well as exit directions become a basis for formulating a tourism planning policy. However, research in examining this paradigm by using a spatial analysis is limited. Therefore, this paper introduces an analysis by using Geographic Information Systems (GIS) to create a visualization of tourist dispersal and mobility. This methodology was implemented in the Great Ocean Road Region, an iconic regional destination in Australia that is experiencing limited tourist dispersal. Results from 351 questionnaires were processed by GIS with a web-based application. The data were processed by using certain tools, including ArcGIS ESRI to create spatial data as well as PHP and JavaScript programming languages to visualize the results. The results show that there is a low geographical dispersal in the region because the hinterland area remains untapped while the coastal area receives abundant of tourists. It is aggravated by limited tourist mobility due to the same directions of tourists’ arrival and exit. With GIS technology, the visualization of this spatial analysis shows a possible tourism pressure that is worth noted by policymakers in the planning and development process.

1. Introduction
Tourism is broadly viewed as an economic and societal phenomenon that requires measured actions to ensure a positive development direction. Therefore, planning and development have long been a concern for tourism researchers. Many studies interpret development as a process that focuses on qualitative dimensions as an objective [1-3]. The development in tourism is expected to achieve sustainable goals in the economic, social, and environment [4,5]. In this regard, planning acts as a tool for guiding tourism to the development objectives that create benefits to the industry and surroundings [6].

Tourist mobility is a vital element in tourism planning and development. Mobility is reckoned as a prerequisite for tourism development [7] as it becomes a basis in shaping a destination’s strategy. Research in tourism mobility studies is not only limited to traffic or transportation system in the destination, but also about an extensive examination on tourists’ movement during their visit [8,9]. Tourists’ mobility is assessed by investigating from which direction they enter and exit as well as the stopovers during their trip.
Likewise, when tourists are moving, there is geographical dispersal to favorite destinations. These tourists’ visitations undeniably give economic impact to the destinations [10]. Therefore, tourists’ dispersal is often stated as a long-term goal of the regional economy. Because it does not only reduce the congestive pressure in the urban area, but it also creates a wider spread of socio-economic benefits such as income, employment, and investment in the region [11]. Thus, the failure to optimize tourist dispersal and mobility often leads to economic, societal and environmental imbalances of the region.

Great Ocean Road Region, a featured regional destination in Australia, is experiencing these issues. The tourists’ visitation reached five million in 2014 from both domestic and international markets, with a direct economic impact of 6.1% to the region. However, with its proximity to Melbourne, this considerable number of visitors was only dominated by the day-trippers than the overnight visitors [12]. Twelve Apostles, the most iconic sea-shore attraction in the region, drew an abundant of tourists, yet caused a significant dispersal imbalance to other areas. It was aggravated by the monotonous movement of tourists during their trip to that region which caused more pressure on the already dense area. This circumstance describes the paucity of strategic governance with tourists’ visitation as the key performance indicator [13] when less attention is given to their dispersal and mobility. Therefore, a comprehensive spatial analysis of this situation becomes a basis in restructuring the region’s planning and development process.

Geographical Information System (GIS) offers a way to visualize this objective. One form of spatial data such as road layers, forest layer, points of interest, and visitation are then combined into one integrated layer to obtain comprehensive information describing particular issues. In tourism, GIS has slowly reshaped governance with many applications, such as tourism information systems, application of tourist attractions, mitigation of hazards and risks of tourist attractions, and mapping of public interests. In this paper, GIS is applied to describe the tourist dispersal and mobility in the Great Ocean Road Region. With GIS technology, clear visualization of this spatial analysis hopefully will help policymakers understand tourist dispersal and mobility in their region better and consequently will contribute to the tourism planning and development strategy.

2. Methods
The population of this study was domestic and international tourists who visited the Great Ocean Road Region. Using a convenient sampling approach, 351 questionnaires in this survey were distributed in Apollo Bay, Lorne, and Port Campbell. The questionnaire consisted of several parts, including demographic profiles, tourists’ visitation, as well as their arrival and exit direction to the destinations. The data were processed by using Statistical Packages for Social Sciences (SPSS) to generate descriptive results of the survey.

The results were then analyzed by ArcGIS ESRI to process the spatial data and PHP as well as JavaScript programming languages to visualize the data. The descriptive results based on the coordinate of attractions and townships were converted to the GeoJSON file and reproduced by a web-based map to create spatial data of tourist dispersal. The same method was also implemented in spatial data of tourist mobility with the arrival and exit direction based on the state highway and road that were divided into two routes: the coastal and the hinterland. The various colors on the map represent layers of each variable.

3. Results and discussions

3.1. Demographic profile
The result in Table 1 indicates that the international tourists had dominated the visitation to the Great Ocean Road Region with 69%, while domestic tourists with only 31%. The people from China had become the major contributor of international tourists to the Great Ocean Road region, with around 22% of total respondents, followed by the ones from UK and Germany. Meanwhile, nearly half of domestic tourists were dominated by Victorians, followed by interstate visitors from New South Wales and
Queensland with 27% and 21% of total respondents, respectively. The majority of both international and domestic tourists were female, between 22-35 years old, and professionals.

Table 1. Demographic of respondents.

| Gender | Domestic | International |
|--------|----------|---------------|
| Male   | 29%      | 71%           |
| Female | 32%      | 68%           |

| Age     | Domestic | International |
|---------|----------|---------------|
| <21 years | 17%     | 83%           |
| 22-35 years | 20%     | 80%           |
| 36-51 years | 29%     | 71%           |
| 52-69 years | 58%     | 42%           |
| >69 years  | 48%     | 52%           |

| Occupation  | Domestic | International |
|-------------|----------|---------------|
| Professional | 25%      | 75%           |
| Trade & Services | 30%     | 70%           |
| Student      | 31%      | 69%           |
| Self-Employed | 14%     | 86%           |
| Retired      | 58%      | 42%           |
| Unemployed   | 18%      | 82%           |

![Figure 1. Origin of international tourists.](image1)

![Figure 2. Origin of domestic tourists.](image2)

3.2. *Tourist dispersal*

The Great Ocean Road Region comprises several townships, start from Torquay and stretch westwards along the south coast of Victoria to the South Australian border, as well as the hinterland area on the north side of the region. The map in Figure 3 indicates that the majority of tourists visited the townships that are located in the coastal area; Port Campbell ranks the highest visitation, followed by Apollo Bay and Lorne. In contrast, the townships in the hinterland area, such as Camperdown and Colac, received fewer visitations.

The Great Ocean Road Region also encompasses a number of tourist attractions, from the beautiful beaches along the coastline to the majestic rainforest of the Otways in the hinterland area. The map indicates that the most visited attractions are also the sea-shore destinations. The iconic Twelve Apostles drew an abundant of tourists, followed by Loch Ard Gorge and Gibson Steps, which are also located in
the coastal area nearby. On the other hand, only a few tourists visited the attractions located in the eastern part of the region (i.e., Flagstaff Hill Maritime Village, Tower Hill, and Port Fairy Wharf).

![Figure 3. Tourist dispersal.](image)

**Table 2. Township visitation.**

| Township     | Value |
|--------------|-------|
| Torquay      | 139   |
| Anglesea     | 128   |
| Aireys Inlet | 84    |
| Lorne        | 202   |
| Apollo Bay   | 262   |
| Port Campbell| 274   |
| Warnambool  | 109   |
| Peterborough | 71    |
| Port Fairy   | 82    |
| Portland     | 63    |
| Camperdown   | 39    |
| Colac        | 89    |

**Table 3. Attraction visitation.**

| Attraction             | Value |
|------------------------|-------|
| Lorne Pier             | 113   |
| Erskine Falls          | 89    |
| Great Otway National Park | 166   |
| Gibsons Steps          | 122   |
| London Bridge          | 178   |
| Loch Ard Gorge         | 186   |
| 12 Apostles            | 322   |
| Flagstaff Hill         | 45    |
| Maritime Village       |       |
| Tower Hill WR          | 48    |
| Port Fairy Wharf       | 54    |

3.3. **Tourist mobility**

The Great Ocean Road Region has several entries and exit gates from and to the state highway and roads. The gate via the southern part of the region starts from Torquay and stretches along the coastal line to Port Fairy. Furthermore, the gate via the northern part of the region in the hinterland area starts from Winchelsea to Warnambool. Both of the gates apply two-way directions that mean tourists can enter and exit via the same road. The map in Figure 4 indicates that there is a significant difference in tourist mobility in the term of entering and exiting the region. Most of the tourists entered and exited from the same direction via the coastal road, while only a few tourists traversed the hinterland road. The map also indicates that there is a monotonous movement of the tourist mobility which delineates the limited tourist dispersal in the region.
Figure 4. Tourist mobility.

Table 4. Entry and exit gate.

| Valid                                      | Value |
|--------------------------------------------|-------|
| Entry via coastal area (from East)         | 290   |
| Entry via coastal area (from West)         | 43    |
| Entry via hinterland area (from North)     | 18    |
| Exit via coastal area (to East)            | 212   |
| Exit via coastal area (to West)            | 56    |
| Exit via hinterland area (to North)        | 83    |

4. Conclusion
With GIS technology, the georeferenced data of the Great Ocean Road Region in a digital map show a possible tourism pressure that is worth noted by policymakers in the planning and development process. The coastal area is experiencing a critical state with a surge in tourists’ visitation and their monotonous movement. In contrast, the hinterland region remains mostly untapped with low visitation and limited mobility in the area. Therefore, the Great Ocean Road Region needs viable strategies that focus on combating the dispersal and mobility issues in its tourist destinations.

This study concludes that GIS technology can be used as an appropriate tool for tourism destination planning and development. It can help tourism planners and managers understand tourist destinations spatially and capture possible issues experiencing by the region. Furthermore, it offers a spectrum of opportunities to develop new tourism products or services that support tourism planning and development. Limited studies in the GIS and tourism issues, such as tourism marketing, also open the range of options for further researches.

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