Tourism and Territory: Spatial-Temporal Analysis of Accommodation Facilities in Central Philippines

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Abstract. This study investigates the spatial and temporal distribution of accommodation facilities in Central Philippines to understand the factors influencing accommodation location choices and their impact on regional tourism development. The study employed spatial analysis techniques, including nearest neighbor analysis and kernel density estimation within a GIS, to analyze the distribution of accommodation facilities across the region. Data were collected from multiple sources, including surveys of hotel owners/managers and guests (n=400), supplemented by information from travel web locator applications and Google Maps. Results reveal significant hotel clustering in Cebu City, Mactan Island, Oslob, Dumaguete City, Siquijor, and Panglao. This clustering indicates the influence of agglomeration economies. Analysis of temporal trends shows a diffusion of hotel clusters over time. New clusters emerged in Oslob, Bantayan, Panglao, and Dauin during the 2010s. Prior research has shown essential location criteria for accommodation providers, such as closeness to attractions and available infrastructure, and for visitors, including safety and ease of access. The results indicate that agglomeration economies significantly impact decisions regarding accommodation locations, affecting the success of accommodation facilities and regional tourism growth. While this study provides valuable insights, its reliance on data is limited to specific sources and periods. The survey data may not fully capture the nuances of decision-making processes. Future research could benefit from incorporating more recent and qualitative data and exploring the impact of factors beyond agglomeration economies. Grasping these spatial dynamics is essential for efficient tourism planning and sustainable development approaches in Central Philippines.

Keywords: Accommodation facilities; Central Philippines; Geographic information system; Spatial and temporal maps; Spatial statistics.

1.0 Introduction

Central Philippines, particularly the Central Visayas region, represents a significant tourism hub within the Philippines. The rapid growth of its tourism sector necessitates a deeper understanding of its accommodation facilities' spatial and temporal dynamics. Tourism is recognized as a crucial driver of economic growth and development, contributing significantly to investment, employment, and culture (Añasco & Lizada, 2014). In the Philippines, the tourism sector has been identified as a priority sector, aligned with national development goals (Añasco & Lizada, 2014). Cebu, in particular, has consistently attracted a large share of domestic and foreign tourists owing to its diverse attractions and well-developed infrastructure. The increasing demand for accommodations in the region reflects the sector's growing importance.

Existing literature on tourism in the Philippines has explored various aspects, including sustainable tourism practices, community-based tourism initiatives (Andalecio & Martin, 2022), and the impact of tourism on local

economies (Sainz & Samorin, 2021). Several studies have focused on the evolution and typology of tourism in the Philippines (Añasco & Lizada, 2014). While these studies provide valuable insights into the broader tourism landscape in the Philippines, a gap remains in the specific analysis of spatial-temporal patterns of accommodation distribution within Central Visayas. Few studies comprehensively address how accommodation facilities' spatial arrangements evolve and influence regional tourism development.

This research addresses this gap by investigating the spatial-temporal distribution of accommodation facilities in Central Philippines between 2002 and 2018. Drawing upon tourism geography (Timothy, 2017), this study utilizes key concepts such as spatial-temporal distribution, referring to the arrangement of phenomena across geographical space and its changes over time, and agglomeration economies, the benefits derived from the clustering of businesses. By employing spatial analysis techniques, including nearest-neighbor analysis and geocoding (McDonald et al., 2017), this study aims to identify patterns of clustering and dispersion of accommodation facilities and their relationship with factors like tourist attractions and infrastructure. This research contributes to understanding the spatial dynamics of tourism development in Central Philippines and provides insights for policymakers and tourism planners to develop sustainable and equitable growth strategies for the region. This study aims to determine how spatial-temporal patterns of accommodation facilities have evolved, what factors influence their location, and how agglomeration economies contribute to regional tourism development.

2.0 Methodology

2.1 Research Design
This study employs a mixed-methods approach incorporating correlational analysis to investigate the spatial and temporal distribution of accommodation facilities in Central Philippines and their influence on regional tourism development. The research combines secondary data analysis with primary data collection through surveys.

2.2 Research Locale
This study focused on the spatial-temporal patterns of accommodation distribution in Central Visayas, Philippines. The region encompasses four provinces: Bohol, Cebu, Negros Oriental, and Siquijor, and includes the three highly urbanized cities of Cebu City, Lapu-Lapu, and Mandaue. Cebu City served as the primary focus of the research. While the official lists of registered hotels from the DTI, SEC, and DOT provided a foundation, the study also incorporated data from online travel platforms and Google Maps to ensure a comprehensive inventory of accommodation facilities, including those not formally listed.

2.3 Research Participants
Data were gathered from 200 accommodation owners/managers and 200 accommodation guests from different establishments in Central Philippines, providing balanced perspectives. The sample size allows for meaningful statistical analysis and enhances statistical power. Accommodation establishments were selected to represent the diversity of the sector in Central Philippines. Guests were selected from those staying at the establishments' during data collection, using convenience sampling while ensuring diversity where possible. Using convenience sampling for guests may introduce selection bias, and the sample may not fully represent all tourists. Despite these limitations, the sample size and diversity provide a reasonable basis for conclusions.

2.4 Research Instrument
This study investigated the factors influencing hotel location choice and performance using a mixed-methods approach, combining survey questionnaires, semi-structured interviews, and secondary data analysis. This study developed two distinct questionnaires, one for hotel owners/managers and another for hotel guests, adapting the individual evaluation model from Adam and Amuquandoh (2013) to ensure validity and reliability. To ensure the validity of the questionnaires, a pilot test was conducted. The questionnaires were administered to a small group of respondents with similar characteristics to the target population to assess their comprehensibility and relevance. Based on the feedback received, minor revisions were made to improve clarity and ensure that the questions effectively addressed the research objectives.

Content validity was established through a review by tourism and hospitality management experts, ensuring the questionnaire covered all relevant aspects of hotel location choice and performance (Hlee et al., 2018). Construct validity was assessed through factor analysis, identifying key dimensions affecting location decisions and business performance. The reliability of the questionnaires was assessed using Cronbach's alpha, a measure of internal consistency (Ranganathan et al., 2024). Cronbach's alpha values of 0.70 or higher were considered acceptable, indicating that the items within each questionnaire section consistently measured the same construct (Ranganathan et al., 2024). The results of the reliability analysis will be presented in the results section.

This study employed a mixed-methods approach, utilizing quantitative and qualitative data analysis techniques to understand hotel location choice and performance in Central Philippines comprehensively. Quantitative data gathered through structured questionnaires were analyzed using descriptive and inferential statistics. Descriptive statistics, such as means, standard deviations, and frequencies, were used to summarize the demographic characteristics of the respondents and the importance and satisfaction ratings of hotel location factors. Inferential statistics, including factor analysis and multiple regression analysis, were employed to identify key dimensions affecting location decisions and to determine the relationships between various factors and hotel performance (McDonald et al., 2017). This study used Factor analysis to reduce the dimensionality of the location factors and identify underlying constructs (Shrestha, 2021). Multiple regression analysis was used to predict hotel performance based on location factors and other variables. Statistical significance was set at $p < 0.05$. Quantitative data were analyzed using statistical software packages. Spatial analysis and mapping were conducted using QGIS and CrimeStat.

Qualitative data obtained through semi-structured interviews with hotel owners and managers were analyzed using thematic and narrative analysis. The thematic analysis involved coding the interview transcripts to identify recurring themes and patterns related to location-related decision-making processes. Narrative analysis explored how hotel owners/managers structure their location choices narratively, providing deeper insights into their decision-making processes (McDonald et al., 2017).

2.5 Data Gathering Procedure
A convenience sample of 200 guests and 200 accommodation facilities (hotels, resorts, inns, guest houses, bed and breakfasts, and pension houses) was drawn from a comprehensive list of registered establishments. This mixed-methods study combined secondary data analysis with a survey employing both descriptive and inferential statistical methods. Hotel locations, geocoded using Google Maps, were mapped and analyzed using QGIS and other spatial analysis software. This approach facilitated the investigation of hotels' spatial distribution and performance in Central Philippines.

2.6 Ethical Considerations
This study was conducted based on ethical considerations, including obtaining consent from the participants and ensuring the protection of personal information per the Data Privacy Act of 2012.

3.0 Results and Discussion
This study aims to look into the intricate patterns and temporal dynamics governing the spatial and temporal distribution of accommodation facilities in Central Philippines. The results are presented in this section, which is divided into two subsections: (a) Descriptive Spatial Statistics- mean centres (MCs) and standard deviational ellipses (SDEs); (b) Inferential Analysis; and (c) Kernel Density Estimation.

3.1 Distribution of Accommodation Facilities
Table 1 illustrates the distribution of accommodation facilities across the four provinces of Central Visayas from 1901 to 2019. As observed, Cebu province hosts the majority of these facilities, followed by Negros Oriental and Bohol, with Siquijor having the fewest. Kyung et al. (2018) support that the number of hotels is a critical variable in each country that shows hotels' spatial cluster patterns. Siquijor boasts a higher proportion of guesthouses than the other provinces. This aligns with Cebu's status as a primary entry point for international travellers and a significant business hub, making it a desirable location for accommodation development. Cebu's tourism industry has become a significant player in economic growth for several decades in the Visayan archipelago, ranking Cebu first in the province in terms of economic performance, tourism industry outputs, and potential. As the Cebu

tourism industry flourishes, the benefits ripple to the neighbouring islands of Bohol, Negros Oriental, and Siquijor provinces. In 2014, Cebu attracted nearly 84 per cent of foreign visitors (McDonald et al., 2017). The concentration of accommodation facilities in Cebu likely reflects its robust tourism industry and role as a regional economic driver, benefiting neighboring provinces through spillover effects. Agglomeration economies are the benefits that firms or businesses receive when they are located close to each other. Accommodations can positively and negatively impact local communities, including job creation, economic development, environmental degradation, and cultural disruption.

Table 1. *Distribution of Accommodation Facilities According to Province and Type, 1901-May 2019 (n=400)*

	Apartelle	Guest house	Hotel	Motel	Pension house	Resort	Tourist Inn	Grand Total
Bohol	1	4	27	1	39	85	47	204
Cebu	0	12	151	1	121	305	117	707
Negros Oriental	0	4	24	2	41	100	44	215
Siquijor	1	22	2	0	10	60	21	116
Grand Total	**2**	**42**	**204**	**4**	**211**	**550**	**229**	**1242**

3.2 Diffusion of Accommodation Facilities

Table 2 shows the diffusion of accommodation facilities over time by province. In the decades leading up to 1972, the Philippine tourism industry was in its initial stages. Examining the spatial-temporal distribution of accommodation facilities reveals a relatively stable and flat trend. As defined, spatial-temporal distribution refers to the arrangement of phenomena across geographical space and how this arrangement changes over time. This suggests that the arrangement of phenomena across geographical space, such as hotels and other lodging options, remained unchanged over time. Kim et al. stated that many hotel properties developed in specific geographical regions over time. The limited infrastructure of this era was a significant constraint.

This finding aligns with the concept of tourism geography, where the relationship between tourism, space, and place was still nascent. The industry's major problem during the period was the lack of or underdeveloped infrastructure to support tourism. This lack of infrastructure would have limited the location of tourist attractions, the movement of tourists, and the impacts of tourism on the environment and local communities. It was not until the later part of that decade that establishments rose steeply overall, especially in Cebu, Negros Oriental, and Bohol. Siquijor experienced the surge more recently, in the later part of the second decade of the 21st century, because of the increased number of established accommodations. From 2001 onwards, a southward shift is evident, with increased accommodation establishments in southern Cebu, Negros Oriental, Bohol, and Siquijor.

Table 2. *Diffusion of Accommodation Facilities by Province over Time*

Decade	Bohol	Cebu	Negros Oriental	Siquijor	Total
1901-1910	0	0	1	0	1
1911-1920	0	0	0	0	0
1921-1930	0	0	0	0	0
1931-1940	1	1	0	0	2
1941-1950	0	0	0	0	0
1951-1960	0	2	0	0	2
1961-1970	1	0	0	0	1
1971-1980	1	6	1	0	8
1981-1990	2	6	2	1	11
1991-2000	4	44	12	2	62
2001-2010	14	112	35	5	166
2011-May 2019	181	538	164	108	990
Total	**204**	**708**	**215**	**116**	**1243**

As Table 3 indicates, the surge in diffusion in establishing accommodation facilities in the later part of the 21st century was primarily driven by resorts, tourist inns, and pension houses. Resorts comprised the most significant proportion of this growth, while tourist inns and pension houses followed similar trends—many hotel properties developed in specific geographical regions over time. The concept of agglomeration economies can lead to benefits such as higher occupancy rates or increased profitability for hotels that cluster together. Guest houses only increased in number in the later part of the second decade of the 21st century. This mirrors the "guest house fever"

observed in Marrakesh, as Kalaska (2015) noted, where many people converted traditional dwelling houses into guest houses in the first decade of the 21st century.

The surge in accommodation facilities, particularly resorts, tourist inns, and pension houses, can be attributed to the policy support provided by RA 9593, also known as The Tourism Act of 2009, and the DOT's efforts to promote entrepreneurship in ecotourism. Añasco and Lizada (2014) mention that the DOT, in cooperation with the Philippine Convention & Visitors Corporation, initiated the Grassroots Entrepreneurs for Ecotourism program to promote entrepreneurship and provide livelihood opportunities in the country's ecotourism.

Table 3. *Diffusion of Accommodation Facilities by Type over Time, 1901-2019*

Decade	Apartelle	Guest house	Hotel	Motel	Pension house	Resort	Tourist inn	Grand Total
1901-1910	0	0	1	0	0	0	0	1
1911-1920	0	0	0	0	0	0	0	0
1921-1930	0	0	0	0	0	0	0	0
1931-1940	0	0	0	0	1	1	0	2
1941-1950	0	0	0	0	0	0	0	0
1951-1960	0	0	0	0	0	1	1	2
1961-1970	0	0	1	0	0	0	0	1
1971-1980	0	0	2	0	3	2	0	8
1981-1990	0	0	2	0	1	8	0	11
1991-2000	0	1	20	0	13	20	8	62
2001-2010	0	4	42	1	23	69	28	165
2011-May 2019	2	37	136	3	170	449	193	990
Total	**2**	**42**	**204**	**4**	**211**	**550**	**230**	**1243**

As evident in Table 4, there was an increase in the growth of guest house establishments in 2018, especially in Siquijor, but with a significant decrease in 2019. Siquijor, known for its mystical traditions, has successfully capitalized on its appeal to tourists seeking authentic and immersive travel experiences. This includes considering factors such as proximity to attractions, transportation infrastructure, and the characteristics of the surrounding environment, all of which are elements of tourism geography. Previous studies found that tourists choosing alternative accommodations, like guesthouses and homestays, are influenced by the enjoyment of the country lifestyle and scenery, an alternative to a hotel or a getaway to escape the more massive hotel, meet the local people and enjoy the local heritage. Yu et al. (2015) found that value for money and the influence of "home-like" ambience were primary factors in influencing the motivational pull of unique attractions associated with alternative hoteliers. Moreover, their study emphasized that the tourism industry boom has resulted in the emergence and rapid increase in the number of guest houses in several destinations in the country.

Table 4. *Diffusion of Guest Houses by Type over Time, 1901-2019*

Decade	Bohol	Cebu	Negros Oriental	Siquijor	Total
1901-1910	0	0	0	0	0
1911-1920	0	0	0	0	0
1921-1930	0	0	0	0	0
1931-1940	0	0	0	0	0
1941-1950	0	0	0	0	0
1951-1960	0	0	0	0	0
1961-1970	0	0	0	0	0
1971-1980	0	0	0	0	0
1981-1990	0	0	0	0	0
1991-2000	0	0	1	0	1
2001-2010	0	3	1	0	4
2011-May 2019	4	9	2	22	37
Total	**4**	**12**	**4**	**22**	**42**

Table 5 shows the diffusion of hotels over time by province. As shown, the trend of hotel diffusion was relatively high in the later part of the second decade of the 21st century. The spatial-temporal distribution refers to the arrangement of phenomena across geographical space and how this arrangement changes over time. In the later part of that decade, Cebu experienced a surge in hotel establishments. This aligns with agglomeration economies where hotels clustering together can lead to benefits such as higher occupancy rates or increased profitability. According to Chan et al. (2016) and Qi et al. (2017), hotels have increased substantially recently, and new hotels

are expected to open by 2019. The demand from tourists greatly influenced these increases. Government initiatives during the 21st century encouraged tourism development as an integral part of the country's sustainable tourism framework. The Philippine government recognized tourism as the national economy's indispensable element and an industry of national importance, utilizing it as a driver of socio-economic growth.

Table 5. *Diffusion of Hotels by Province over Time, 1901-May 2019*

Decade	Bohol	Cebu	Negros Oriental	Siquijor	Total
1901-1910	0	0	1	0	1
1911-1920	0	0	0	0	0
1921-1930	0	0	0	0	0
1931-1940	0	0	0	0	0
1941-1950	0	0	0	0	0
1951-1960	0	0	0	0	0
1961-1970	1	0	0	0	1
1971-1980	1	2	0	0	2
1981-1990	0	2	0	0	2
1991-2000	0	17	3	0	20
2001-2010	2	33	7	0	42
2011-May 2019	23	97	15	2	136
Total	**27**	**151**	**25**	**2**	**204**

Table 6 presents the diffusion of pension houses by province over time. As evident in the data presented, there was a significant surge in the second decade of the 21st century, specifically in the province of Cebu. Pension houses ranked second, having similar trends with tourist inns. The hotel industry serves the accommodation needs of many domestic and international travellers; hotels are considered a traditional type of tourist accommodation. However, tourists are increasingly opting for alternative accommodation, like pension houses, which provide short-term lodging options to tourists on a paid basis (Mangali et al., 2021).   Pension houses emerged after the widened economic reforms in the 1980s, and the efforts to increase the number of hotels ramped up to cater to the needs of more stimulating business activities. This study revealed that the earliest pension house, the Oasis Balili Heritage, was built in Bohol in 1934. The owner, Mr. Balili, used it as the venue of Tagbilaran's grand social functions, which were attended by prominent political and social personalities from both local and national levels. It has a vibrant cultural value, which will help people understand the rich culture of the Tagbilaranons and the Boholanos in general.   The spatial-temporal distribution of pension houses, as evidenced by the surge in Cebu during the second decade of the 21st century, reflects the changing preferences of tourists and the increasing importance of alternative accommodations. As tourism geography suggests, these accommodations' location and proximity to attractions and cultural sites play a significant role in their success.

Table 6. *Diffusion of Pension Houses by Province over Time, 1901-May 2019*

Decade	Bohol	Cebu	Negros Oriental	Siquijor	Total
1901-1910	0	0	0	0	0
1911-1920	0	0	0	0	0
1921-1930	0	0	0	0	0
1931-1940	1	0	0	0	1
1941-1950	0	0	0	0	0
1951-1960	0	0	0	0	0
1961-1970	0	0	0	0	0
1971-1980	0	3	0	0	3
1981-1990	0	0	1	0	1
1991-2000	0	10	3	0	13
2001-2010	1	14	8	0	23
2011-May 2019	37	94	29	10	170
Total	**39**	**121**	**42**	**10**	**211**

Table 7 depicts the diffusion of resorts by province over time. The diffusion of the establishment of resorts intensified in the later part of the second decade of the 21st century. Resorts comprised the most significant proportion of diffusion. According to the Department of Tourism, the increase in tourist arrivals in the Philippines contributed to the economic growth of the country due to the contribution of the resort industry that offers excellent facilities, products, and services both to the foreign and local markets (Enriquez-Magkasi & Caballero, 2014). This aligns with the government recognizing tourism as an indispensable element of the national economy, utilizing it as a driver of socio-economic growth. This diffusion of resorts can be analyzed through the lens of

tourism geography, considering factors such as proximity to attractions, transportation infrastructure, and the characteristics of the surrounding environment, as resorts would cluster where they have the best access to these factors. Spatial-temporal distribution refers to the arrangement of phenomena across geographical space and how this arrangement changes over time, and the distribution of resorts reflect.

Table 7. *Diffusion of Resorts by Province over Time, 1901-May 2019*

Decade	Bohol	Cebu	Negros Oriental	Siquijor	Total
1901-1910	0	0	0	0	0
1911-1920	0	0	0	0	0
1921-1930	0	0	0	0	0
1931-1940	0	1	0	0	1
1941-1950	0	0	0	0	0
1951-1960	0	1	0	0	1
1961-1970	0	0	0	0	0
1971-1980	0	1	1	0	2
1981-1990	2	4	1	1	8
1991-2000	4	11	3	2	20
2001-2010	9	45	10	5	69
2011-May 2019	70	242	85	52	449
Total	**85**	**305**	**100**	**60**	**550**

Table 8 shows the diffusion of tourist inns by province in Central Philippines over time. As seen, the diffusion of establishing tourist inns in the second decade of the 21st century contributed to Cebu predominantly. The increase greatly influenced the tremendous growth of tourist inns in response to tourist demand. This increased demand aligns with the concept of tourism geography, where the location of tourist inns and their proximity to attractions influence tourism development. The whale shark tourism is attributed to the boom in the southern part of Cebu. As Kennedy Warne and PhilStar Global reported, National Geographic has cited Oslob in Cebu for its shark tourism industry, describing it as a booming business despite its effects on wildlife. Wong et al. (2019) also added that shark tourism in Oslob has become the most significant venture in the world since it began in 2011. This reflects the spatial-temporal distribution of tourism, with a shift towards the southern portion of the region. The rise of whale shark tourism in Oslob exemplifies how specific attractions can drive the growth of accommodation facilities in a particular area. This phenomenon highlights the importance of understanding the relationships between tourism, space, and place.

Table 8. *Diffusion of Tourist Inns by Province over Time, 1901-May 2019*

Decade	Bohol	Cebu	Negros Oriental	Siquijor	Total
1901-1910	0	0	0	0	0
1911-1920	0	0	0	0	0
1921-1930	0	0	0	0	0
1931-1940	0	0	0	0	0
1941-1950	0	0	0	0	0
1951-1960	0	1	0	0	1
1961-1970	0	0	0	0	0
1971-1980	0	0	0	0	0
1981-1990	0	0	0	0	0
1991-2000	0	6	2	0	8
2001-2010	2	17	9	0	28
2011-May 2019	45	94	33	21	193
Total	**47**	**118**	**44**	**21**	**230**

3.3 Spatial and Temporal Maps of Hotels in Central Philippines
Descriptive Spatial Statistics

Figure 1 presents the mean centres and standard deviational ellipses, illustrating the spatial-temporal diffusion of accommodation facilities in Central Visayas. During the 20th century, development concentrated in the northern part of the region, particularly around Cebu City. However, from 2001 onwards, a southward shift is evident, with increased accommodation establishments in southern Cebu, Negros Oriental, Bohol, and western Siquijor. This southern trajectory aligns with the rise of whale shark tourism in Oslob, Cebu, a significant driver of regional tourism growth since 2011. (Wong et al., 2019). The rapid expansion of tourism in Oslob necessitates careful consideration of carrying capacity and appropriate political interventions to ensure sustainable development

(Ziegler et al., 2020). The observed spatial clustering, confirmed by the nearest neighbour analysis in Figure 3, further emphasizes the localized impact of whale shark tourism and the need for targeted management strategies. The significant clustering of hotels established between 2011 and 2019 underscores the rapid growth in this period and the potential strain on local resources.
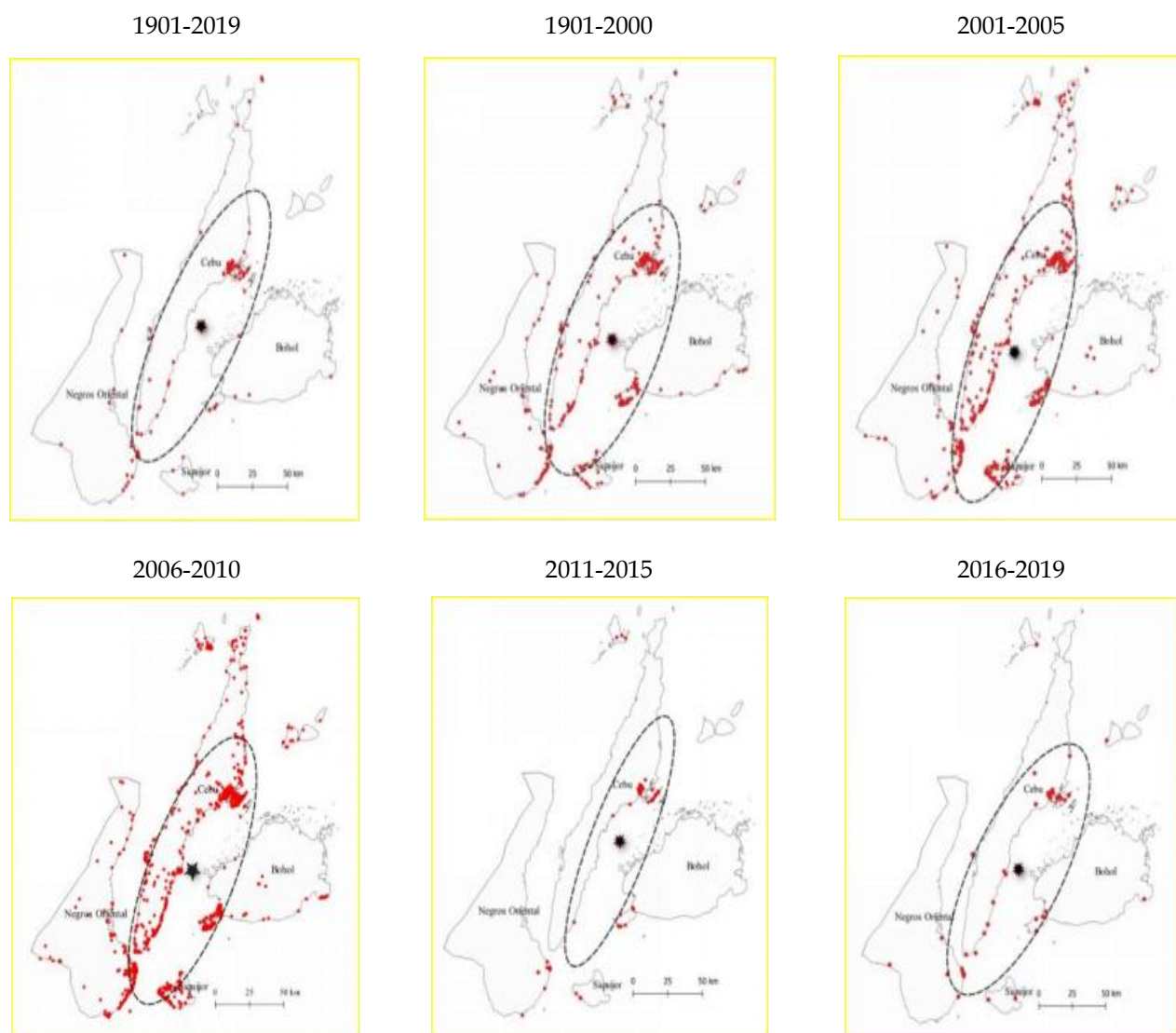
1901-2019	1901-2000	2001-2005

2006-2010	2011-2015	2016-2019

Figure 1. *Mean Centers (black stars) and standard deviational ellipses (dashed oblongs)*
of the accommodation facilities in Central Philippines of time

3.4 Inferential Analysis of the Presence of Clustering

To check whether there is a significant clustering of hotels per data aggregation, nearest-neighbour analyses were performed. Indices less than 1 denote hotel clustering, while those greater than 1 do the opposite. As shown in Figure 1, each data group showed spatial clustering up to a particular order, with the highest degree of clustering on hotels established in the years 2011-2015 and 2016-2019. These clustering were significant at the 0.05 level. Thus, hot spots of accommodations per year interval, including the aggregation of all accommodations, were present.

Agglomeration economies are the benefits that firms or businesses receive when they are located close to each other. The study revealed that accommodation clusters could significantly influence the economic well-being of local communities (Albuquerque et al., 2024). Hotels generate income through various means, including

accommodation fees and food and beverage sales, creating an economic multiplier effect that benefits local businesses and suppliers.

Several factors might explain this clustering pattern, such as the emergence of new tourist attractions, improved infrastructure, or agglomeration economies. In this context, aggregation economies refer to the advantages hotels gain by being located near one another, such as access to a more extensive customer base, shared marketing opportunities, or reduced operational costs (Bolter & Robey, 2020). The clustering implies the presence of agglomeration economies, where hotels gain advantages from shared resources, enhanced visibility, and strong network effects. Several studies indicate that hotels in tourist districts may experience a 'U-shaped' relationship between the degree of business agglomeration and hotel profit (Marco-Lajara et al., 2014).
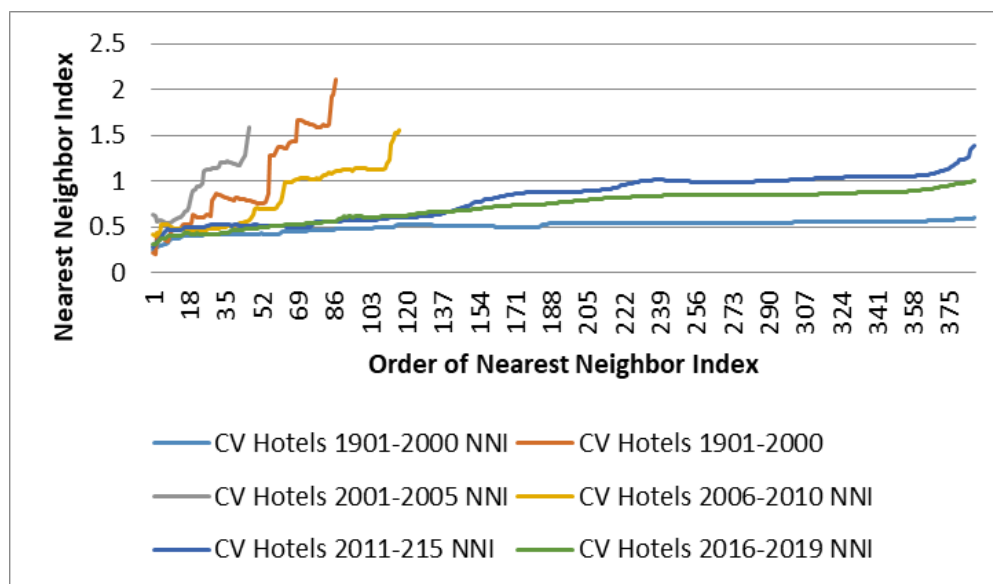
Figure 2. *Nearest Neighbor Indices of the Cluster of Accommodation Facilities over Time*

3.5 Kernel Density Estimation

Following the nearest neighbor analysis, kernel density estimation was employed to visualize the spatial clustering of accommodation facilities in Central Philippines, as shown in Figure 3. Kernel Density Estimation is a method used to estimate the probability density function of a random variable (Weglarzyck, 2018). In this case, KDE helps to identify areas with high concentrations of hotels, essentially creating a smooth density map of hotel locations. This analysis reveals a high concentration of hotels in Cebu City, aligning with its status as a regional hub. This analysis reveals a high concentration of hotels in Cebu City, aligning with its status as a regional hub. Other areas with notable accommodation densities include Dumaguete City and Dauin in Negros Oriental, Panglao and Tagbilaran City in Bohol, Mactan and Oslob in Cebu, and Siquijor and San Juan in Siquijor province. This pattern reflects the agglomeration economies in the hotel industry, where businesses benefit from proximity to competitors and shared resources. Agglomeration economies are the benefits that firms or businesses receive when they are located close to each other. The concentration of hotels in these specific locations likely reflects the distribution of tourist attractions and supporting infrastructure.

This spatial-temporal distribution highlights how the arrangement of hotels across geographical space changes over time, influenced by factors such as tourist attractions and infrastructure. These clusters indicate the presence of accommodation "hot spots."Overall, the hotels in Balikpapan are constructed in an area that is most accessible and close to urban centers (Ghozali & Syafitri, 2020).
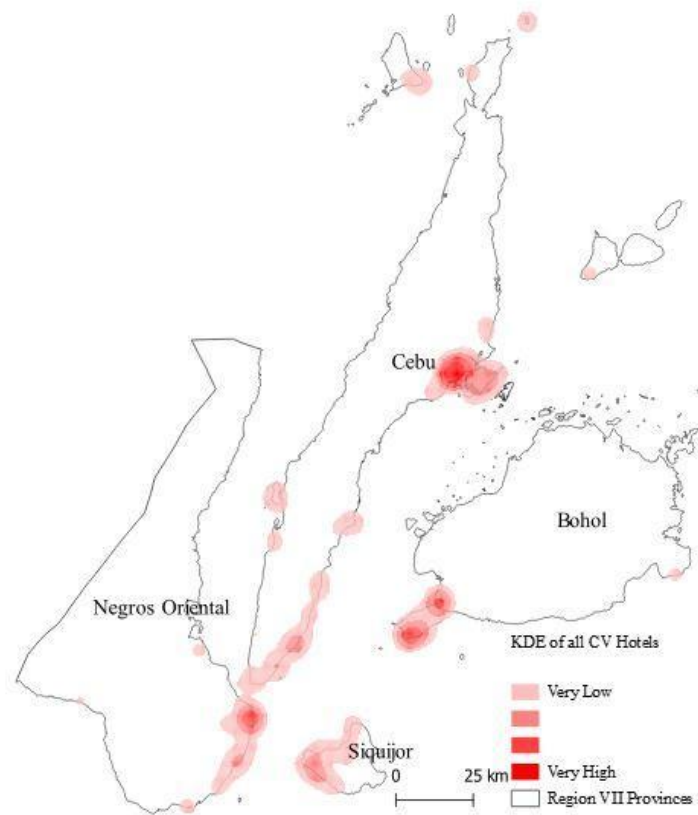
Figure 3. *Kernel Density Map of the Clusters of All Accommodation Facilities in Central Philippines*

Figure 4 presents kernel density estimation maps illustrating the diffusion of accommodation facilities in Central Philippines over time. The maps reveal a dynamic pattern of hotel development, with clusters shifting and emerging across different periods. While Cebu City, Dumaguete City, and Tagbilaran City maintained relatively stable hotel clusters, other areas experienced significant growth. Notably, Oslob, Bantayan, Panglao, and Dauin saw increased hotel development in the first half of the 2010s, while Siquijor's cluster emerged in the latter half of the decade.

This spatio-temporal variation in accommodation agglomeration aligns with findings on the clustering tendency of hotels due to agglomeration economies, which enhance operational efficiency (Lao & Yang, 2013). Agglomeration economies are the benefits hotels receive by locating close to each other, such as access to a more extensive customer base, shared marketing opportunities, or reduced operational costs. The observed diffusion pattern likely reflects evolving tourism trends, infrastructure development, and local economic conditions. The emergence of Oslob as a tourist destination, driven by whale shark tourism, likely contributed to the growth of its hotel cluster during this period (Legaspi et al., 2020; Ziegler et al., 2016). This is consistent with the principles of tourism geography, which state that the location of tourist attractions influences tourism development. The growth of hotels and resorts creates jobs in various sectors, including hospitality, food service, transportation, and recreation (Añasco & Lizada, 2014). This is particularly important in rural areas, where tourism can provide alternative income sources for local communities.
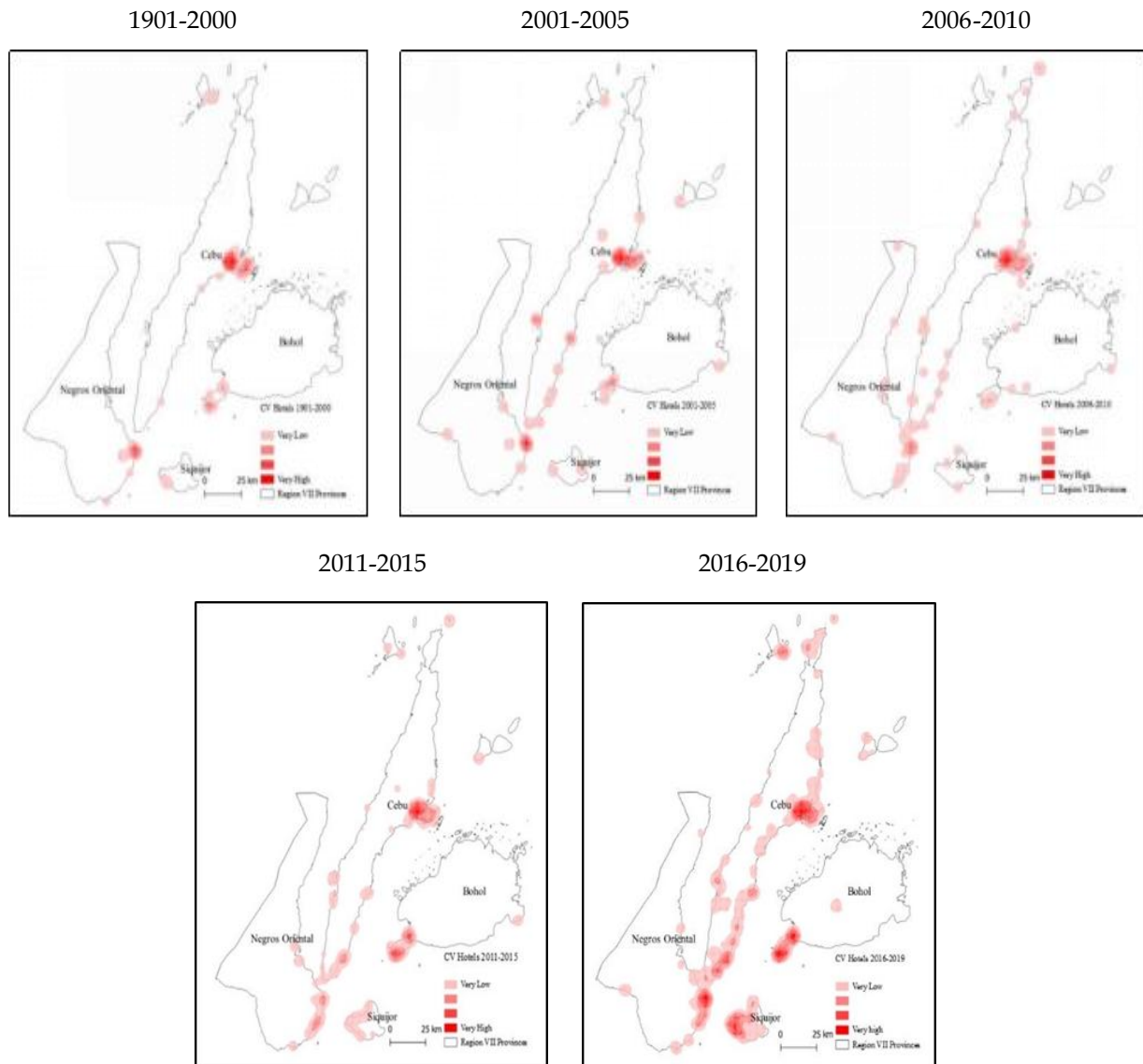
1901-2000   2001-2005   2006-2010

2011-2015   2016-2019

Figure 4. *Kernel Density Estimation Maps of Accommodation Facilities in Central Philippines over Time*

Figure 5 depicts the distribution of hotels in Central Philippines, highlighting prominent clusters in Cebu City, Mactan Island, Oslob (southern Cebu), Dumaguete City, Siquijor, and Panglao. This pattern, as noted, mirrors findings suggesting that hotel owners are drawn to established clusters regardless of existing hotel scales. This tendency towards agglomeration can be attributed to several factors. First, clustering offers access to shared resources and infrastructure, reducing operational costs. Second, it enhances visibility and attracts tourists as these areas become recognized hospitality hubs. Third, the concentration of hotels can create a network effect, fostering collaboration and knowledge sharing within the industry. Agglomeration economies are the benefits that firms or businesses receive when they are located close to each other. Spatial-temporal distribution refers to the arrangement of phenomena across geographical space and how this arrangement changes over time.

The analysis also pointed out the spread of these clusters over time, with new ones appearing in sites such as Oslob, Bantayan, Panglao, and Dauin during the 2010s. This dynamic pattern reflects tourism trends, infrastructure development, and local economic conditions. Balancing the benefits of agglomeration with sustainable development practices is essential for the long-term health of the tourism sector in these areas.

While this study provides valuable insights into the spatial-temporal dynamics of accommodation development in Central Philippines, it is important to acknowledge certain inherent limitations. First, the analysis relies on secondary data from DTI, SEC, and DOT, which may have inconsistencies or gaps in coverage. Geocoding, the process of assigning geographical coordinates to a postal address, can also vary depending on several variables (McDonald et al., 2017). Secondly, while KDE helps identify areas of high hotel concentration, it does not explain why certain hotels perform better than others within those clusters. Factors such as hotel service quality, management practices, and strategic differentiation likely play a significant role (Peiró-Signes et al., 2014). Future studies could explore these factors in more detail to understand the nuances of hotel performance within agglomerated areas. Finally, although it can be inferred that the changes in the spatial pattern of the area surrounding a hotel are related to the hotel's existence, the study cannot quantify this relationship. Despite these limitations, this research contributes to a better understanding of the complex relationship between tourism, territory, and spatial development in Central Philippines.
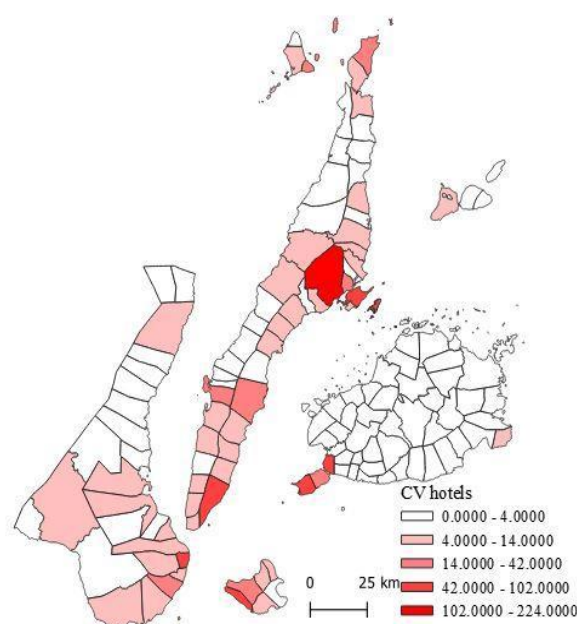

Figure 5. *Distribution of Accommodation Facilities in Central Philippines Using Aerial Mapping*

4.0 Conclusion

This research investigated the spatial-temporal distribution of accommodation facilities in Central Philippines, revealing the influence of agglomeration economies on hotel location decisions and the emergence of new tourism clusters. In this context, spatial-temporal distribution refers to the arrangement of hotels across the geographical space of Central Philippines and how this arrangement has changed over time. The study's findings indicated a concentration of hotels in areas like Cebu City, Mactan Island, Oslob, Dumaguete City, Siquijor, and Panglao, suggesting the presence of agglomeration economies. The research also highlighted the spread of hotel clusters over time, reflecting tourism trends, infrastructure development, and local economic conditions.

However, the study underscores the importance of balancing the benefits of agglomeration with sustainable development practices to mitigate potential negative impacts such as increased competition and strain on local resources. Building upon the principles of tourism geography, the study of tourism from a spatial perspective. This research recognizes the need for strategic interventions to ensure the long-term viability of tourism in the region. Therefore, the following actionable steps, framed as recommendations for sustainable tourism development, including

Sustainable Tourism Planning wherein local government units should develop comprehensive sustainable tourism plans that consider the carrying capacity of each area. This includes implementing zoning regulations to manage hotel density and prevent overdevelopment, prioritizing investments in sustainable infrastructure, such as renewable energy sources, efficient water management systems, and waste reduction programs, as this will help mitigate the environmental impact of tourism and enhance the quality of life for local communities, diversification of Tourism products by encouraging the development of diverse tourism products and experiences beyond the established clusters. This could include promoting eco-tourism, agri-tourism, cultural tourism, and other niche markets to attract more visitors and reduce pressure on popular destinations.

Future research should focus on exploring the specific factors driving hotel development in emerging clusters and investigating the long-term sustainability of these tourism hotspots. Furthermore, longitudinal studies could assess the effectiveness of the proposed recommendations in promoting sustainable tourism outcomes. By implementing these actionable steps, Central Philippines can harness the benefits of tourism while preserving its natural and cultural resources for future generations. This research contributes to the broader understanding of spatial-temporal dynamics in tourism geography and provides a framework for sustainable tourism planning in similar contexts.

5.0 Contributions of Authors

Tulip F. Lopez: Conceptualization, Writing – original draft, Writing – review and editing.

6.0 Funding

7.0 Conflict of Interests

The author declares no conflict of interest.

8.0 Acknowledgment

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