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MORALITY BEFORE KNOWLEDGE

Analysis of palemahan application on tourist attraction and waste conditions in a tourism city

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ABSTRACT

Background: Denpasar City, as a prominent tourism hub in Bali, faces significant urban environmental challenges due to rapid land conversion, increasing population, and growing tourism activities. In 2023, Denpasar produced the highest volume of waste in Bali, reaching 357,985.69 tons/year, reflecting the strain on waste management systems and environmental sustainability. **Methods**: This study uses a quantitative approach through spatial analysis using QGIS and literature review. The variables analyzed include land cover, population, tourist attraction/*daerah tujuan wisata* (DTW) distribution, and annual waste generation across four sub-districts in Denpasar. **Findings**: The analysis revealed that South Denpasar has the largest area (49.89 km^2), highest population (311,590 people), highest waste generation (111,080.23 tons/year), and the most tourist attraction/*daerah tujuan wisata* units (28 DTWs). Despite this, it has the lowest population density compared to other sub-districts. These conditions highlight the environmental burden experienced by this region, particularly in waste management and land use pressure due to its tourism-related activities. **Conclusion**: The city of Denpasar faces complex challenges in achieving its vision as a sustainable Tourism City. The integration of the Balinese local wisdom value of palemahan, emphasizing harmonious human–environment relationships, is crucial to address the physical, biological, and social environmental issues arising from unregulated waste and land use. Furthermore, the dense population and high tourism activity call for future research on their impact on water and air quality. **Novelty/Originality of this article**: This study offers a spatially grounded analysis of the interrelation between tourism, population pressure, and waste generation in Denpasar. It uniquely incorporates traditional environmental values (palemahan) as a cultural approach to addressing urban ecological challenges.

KEYWORDS: tourist attraction; waste generation; tourism city; palemahan.

1. Introduction

Since the 1920s, Bali Province has become an attraction for tourists to come to enjoy Balinese nature and culture. Based on data from the Bali Province Tourism Office, the number of tourists visiting Bali as of August 2024 was 3,538,899. Specifically for the capital city of Bali Province, referring to the Denpasar City Tourism Office Data in 2023, this city has a total of 1,945,896 tourist visitors who visit tourist attractions with details of 408,611 foreign tourists and 1,537,285 domestic tourists.

The presence of tourists is inseparable from the amount of waste generated. Based on data from the National Waste Management Information System in 2023, the amount of waste in Indonesia is 38,315,969 tons per year, with the amount of waste produced by Bali Province as a tourism area amounting to 1,229,234 tons per year with the largest amount of waste generated by Denpasar City which is also a tourism city. Waste production has

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increased significantly in recent years due to urbanization, economic expansion, and higher living standards (Chioatto & Sospiro, 2023).

The waste generated by Denpasar City according to Satu Data Denpasar City in 2023 is 357,985 tons/year with details per sub-district are South Denpasar as much as 111,080 tons/year, East Denpasar as much as 609,901 tons/year, West Denpasar as much as 101,536 tons/year, and North Denpasar as much as 84,466 tons/day. The system for managing waste varies greatly by city, depending on the level of infrastructure, environmental protection regulations and their compliance, as well as the extent of informal settlements (Parris, 2016). Denpasar City has a waste management system that is divided into two such as waste management and waste reduction. Waste management is carried out in various ways such as Waste Bank, TPST / TPS 3R, Self-management, Reduction Due to Restrictions, Collectors, Composting Houses, Containers, TPS, Street Sweeping, City Parks, Residues (TPS 3R, Self-management, and composting houses), TPST (PPID Denpasar City, 2023). One interesting data is the reduction due to restrictions of 7,668 tons/year.

Denpasar City already has various regulations related to waste management, so the effectiveness of environmental law enforcement can be carried out preventively by involving the community in programs related to waste management. This aims to increase public awareness of the importance of a good and healthy environment (Negara & Senastri, 2024). Denpasar City has a Mayor Regulation No. 36 of 2018 concerning Restrictions on the Use of Plastic Bags, this is a form of support for the Bali Governor Regulation No. 97 of 2018 concerning Restrictions on the Use of Single-Use Plastics (Plastic Bags, Plastic Straws and Styrofoam). In 2023, Denpasar City Regional Regulation Number 8 of 2023 concerning the Implementation of Waste Management has been issued, one of which regulates the community to limit waste generation by not using single-use plastics. Single-use plastic waste is the most commonly found product, one of which is in tourist attractions. This suggests that although a ban has been implemented in the region, the impact of reducing single-use plastics has not yet been realized (Hendrawan et al., 2023). Given that Denpasar City is a densely populated city, the waste generated is also high.

Based on One Data of Denpasar City, the area of Denpasar City is 125.97 km2 with a population of 962,900 people, which has a population density of 32,261 people/km2. Based on the Denpasar Mayor's decision on the Determination of Tourist Attractions/*Daerah Tujuan Wisata* (DTW), Denpasar City has 24 units of natural DTW, 23 units of cultural DTW and 6 units of artificial Tourist Attractions/*Daerah Tujuan Wisata* (DTW). South Denpasar sub-district is the most extensive sub-district in Denpasar City covering an area of 49.89 km2 with the highest population of 311,590 people. The waste generated is 111,080 tons/year. South Denpasar has the highest number of Tourist Attractions/*Daerah Tujuan Wisata* (DTW) with 28 units categorized as 17 natural Tourist Attractions/*Daerah Tujuan Wisata* (DTW), 9 cultural tourism attractions and 2 artificial ourist Attractions/*Daerah Tujuan Wisata* (DTW). Tourist Attractions are areas that are the target of tourists to do their tours, so it is also necessary to introduce sustainable tourism (Setiawan et al., 2023).

Sustainable tourism is the development of tourism concepts that can have long-term environmental, social, cultural, industrial, and economic impacts for all local communities as well as visiting tourists (Chandradewi et al., 2024). Based on literature studies related to sustainable tourism with social and environmental aspects, there are three indicators that are at the top level, namely (1) local communities, (2) environmental impacts, and (3) environmental dimensions (Diéguez-Castrillón et al., 2022). From the perspective of environmental science, it is the interdisciplinary study of how humans interact with the biotic and abiotic components of their environment. Environmental science integrates information and ideas from natural sciences such as biology, chemistry, and geology; social sciences such as geography, economics, and political science; and humanities such as ethics (Miller & Spoolman, 2016).

The values of harmony between human relationships with beliefs (parahyangan), humans with humans (pawongan), humans with the environment (palemahan) are contained in *Tri Hita Karana*. *Tri Hita Karana* (THK) is one of the local wisdom of the Balinese people used as a concept for sustainable tourism development (Roth &

Sedana, 2015). In accordance with the definition presented by the Ministry of Religious Affairs of the Republic of Indonesia in 2022, palemahan comes from the word lemah (Javanese language) which means land. Palemahan also means bhuwana or nature. In a narrow sense, palemahan means the area of a settlement or residence. Humans live in a certain environment, including the city environment.

The problem faced by Denpasar City today as a Tourism City is the conversion of land along with the increase in population. It should be noted that the increase in land use change in cultural heritage sites is in line with the increase in tourist population and population caused by the presence of infrastructure (Al-shawabkeh et al., 2023). The analysis conducted in this study is the analysis of land cover, population, distribution of tourist attractions and waste generation through the creation of thematic maps. This is done to determine the relationship between the three variables (population, tourist attractions/*daerah tujuan wisata* (dtw), and waste) in the application of palemahan in the Tourism City located in Denpasar City, Bali Province.

1.1 Environmental science

Environmental science is the interdisciplinary study of how humans interact with the biotic and abiotic components of their environment. Environmental science integrates information and ideas from natural sciences such as biology, chemistry, and geology; social sciences such as geography, economics, and political science; and humanities such as ethics. The three goals of environmental science are (1) to learn how life on earth survives and thrives, (2) to understand how we interact with the environment, and (3) to find ways to solve environmental problems and live more sustainably. Sustainability is the capacity of Earth's natural systems and human cultural systems to survive, thrive, and adapt to changing environmental conditions over the long term (Miller & Spoolman, 2016).

The mutual relationship between living and non-living things is called an ecosystem. There are two types of ecosystems such as natural ecosystems and artificial ecosystems. Natural ecosystems include terrestrial and aquatic ecosystems, and artificial ecosystems include agriculture, reservoirs, and cities (Miller & Spoolman, 2016). Urban Ecosystem Typology is a classification or grouping of different types of ecosystems that exist within urban areas based on their specific characteristics, such as land use patterns, ecological functions, and interactions between natural and artificial components (humans and infrastructure). Urban ecosystems include dynamic interactions between physical, biological and social components that influence each other (Forman, 2014). Five strategies for the future of urban ecology drawn from qualitative and ethnographic empirical research with international ecological communities. These strategies open a discussion on how to address these challenges by recognizing the role and potential of: (1) non-extractive community economies; (2) democratic processes of cooperative action; (3) social approaches to resource management; (4) participatory collaborative governance; and (5) urban diversity and social justice (Pickerill et al., 2024).

1.2 Spatial planning theory

The definition of space in Law No. 32 of 2009 concerning PPLH (article 1) is the environment is a unit of space with all objects, forces, conditions, and living things, including humans and their behavior, which affects nature itself, the continuity of life, and the welfare of humans and other living things. The definition of space in Law No.26 of 2007 concerning spatial planning is a container that includes land space, sea space, and air space, including space within the earth as a unified area, where humans and other creatures live, carry out activities, and maintain their survival.

Urban environments vary widely-as do population sizes, social and economic challenges, community priorities, and levels of autonomy in decision-making. Efforts to integrate the environment in urban planning and management are supported by more

general guiding principles that can be adapted to meet the specific needs of urban centers in different situations (UNEP, 2013).

Sustainable urban areas require a network of green infrastructure critical for biodiversity (creation of habitats and corridors for plants and animals) (Susilo et al., 2021). Important parts of green infrastructure should be included together: city parks, rural parks, regional parks, green spaces near housing, green roofs, green facades, community gardens, urban farms, cemeteries, natural and semi-natural urban green spaces, and green corridors. Street trees and public spaces are also important. Green infrastructure is also important for human sustainability as it can reduce the heat island effect, control air and water pollution, reduce noise, and manage flooding. Therefore, green infrastructure should be fully integrated in urban planning and design (Van Bueren, E., 2012).

Urban environmental planning includes the design of space, transportation, buildings and housing in cities. With its broad scope, the planning dimension is strongly related to the quality of life of citizens. Another dimension related to quality of life is living conditions. Basic needs such as housing, health and security are included in the performance measurement system, along with educational, cultural and tourism facilities (Karal & Soyer, 2024). Urban spaces are routinely altered to suit the tourist experience. Often city dwellers face a dilemma as decision-makers increasingly focus on developing the urban tourist experience (Wise, 2022). Urbanization offers various opportunities to address social and environmental burdens. These sustainability aspects include lower per capita costs of service provision in areas with high population density, more options for recycling, and better opportunities for public transportation use. Cities can therefore contribute significantly to achieving higher resource efficiency (UNEP, 2013).

The behavior of city dwellers is influenced by space and environment. Space is needed for humans to interact socially for their survival. Interaction is one of the other five principles of environmental science such as diversity, interdependence, harmony and sustainability (Miller & Spoolman, 2016). Social interaction has a profound impact on the way people behave in urban spaces. It is primarily about how people behave in their personal lives (Askarizad & Safari, 2020).

1.3 History of Denpasar city

Denpasar City began with the construction and functioning of Denpasar Castle since 1788, which was also the center of government, the center of power of King Badung, then included the center of economic activity, namely the market located to the south. Denpasar City became an Administrative City. With the promulgation of Government Regulation Number 20 of 1978. Law Number 22 of 1999 which was later replaced by Law Number 32 of 2004 concerning Regional Government, the mention of Municipalities of Level II Regions became Cities (Wirawan, 2021).

Denpasar City is located between 08 35'31“ - 08 44'49” South latitude and 115 10'23“ - 115 16'27” East longitude, and is bordered to the north by Mengwi Subdistrict and Badung Regency; to the east by Sukawati Subdistrict and Gianyar Regency; to the south by Kuta Subdistrict, and Badung Regency; and to the west by North Kuta Subdistrict and Badung Regency. Administratively, Denpasar City has four sub-districts with 43 villages. The four sub-districts are East Denpasar, South Denpasar, West Denpasar and North Denpasar. The topography of Denpasar City includes 380 ha of reclamation on Serangan Beach. Thus Denpasar City has a total area of 127.78 km^2 or 12,778 ha. Denpasar City is located in the plain area of 0-75 m above sea level. Denpasar City has three rivers as water sources; Ayung River, Badung River, and Mati River and there are several tributaries including Tukad Tebe, Tukad Abianbase, Tukad Loloan, Tukad Ngejung, Tukad Punggawa, Tukad Rangda, and Tukad Pekasih. Denpasar City has two seasons, namely the rainy season (monsoon) and the dry season and each involves about six months (Wirawan, 2021).

Denpasar City as a Cultural Tourism City has a focal point for the attention of tourist visitors through the celebration or prioritization of cultural traditions. Denpasar City as a Culturally Sensitive City such as replacing bells with Catur Muka statues is done with the

intention of restraining the pace or replacing the weathering of modernization. Creating focal spaces or monuments such as fountains around the main spaces of the city encourages people to engage in social interaction in these places (Askarizad & Safari, 2020). As regulated in the Denpasar Mayor's Decree on the Determination of Tourism Attractions in 2020, that Tourist Attractions/*Daerah Tujuan Wisata* (DTW) are to increase the competitiveness and added value of regional tourism products; increase regional economic growth in the tourism sector; encourage an increase in the quantity and quality of regional infrastructure; and optimize the management of potential regional tourism resources for improving community welfare.

1.4 Sustainable tourism

The three main points in sustainable tourism according to the United Nation World Tourism Organization (UNWTO) are (1) tourism development must maintain ecological processes and help preserve natural heritage and biodiversity; (2) respect the socio-cultural authenticity of local communities; (3) provide fair socio-economic benefits for all stakeholders. In line with these commitments, particularly on the issue of waste, the Global Tourism Plastics Initiative (GTPI) 2022 report states that tackling plastic pollution in the tourism sector by encouraging companies and destinations to implement sustainable practices. The initiative focuses on eliminating the use of plastics, promoting the use of reusable, recyclable and compostable plastics, and encouraging collaboration (Dwiyana Putra, 2021). The hope is that by 2025, tourism operators will be required to commit to eliminating unnecessary plastics, increasing recycling efforts, and shifting to a reuse model.

Tourism in the perspective of environmental sociology sees that existing tourism is seen as not being able to fulfill a good and sustainable management model so that the existing environmental friendliness standards are still low. Exploitation, industrialization and capitalization of the environment are sources of environmental crises that worry many socio-economic actors. Anxiety over the loss of sources of life, the destruction of nature, the emergence of natural disasters and other long-term risks is the focus of problems that need to be addressed immediately (Kristiono and Awan Setia D et al., 2021).

1.5 Waste management

The implementation of waste management based on good environmental governance in Denpasar City has not been effective because there are still many people and businesses that violate or improperly manage waste so that it pollutes the environment. This needs to be followed up by the government by conducting studies and socialization to the community regarding correct and proper waste management (Negara & Senastri, 2024).

Waste management policies in Denpasar City are very adequate, starting from regulations on the use of plastic bags, sorting of organic and inorganic waste and the formation of waste banks (Permatasari et al., 2022). The success of waste management, especially household waste, is most determined by the active participation of housewives/PKK (Suryawan et al., 2021). The waste bank in Pedungan Village, Denpasar has been organized by the local government since 2019. However, the level of awareness of local residents and immigrant residents is still low regarding environmental cleanliness (Putra et al., 2021).

The waste problem can be managed independently by the smallest community known as Banjar/Dusun/Lingkungan in the Desa Adat/Administrative Village through the Waste Bank. Thus, waste can be effectively managed in a Customary Village, called a Desa Adat, which coexists with an Administrative Village through a Waste Bank using the Banjar/Dusun/Lingkungan approach, such as in Sanur Village, South Denpasar District. Thus, the waste disposed of in landfills is only waste left over from the management of the Waste Bank (Suwitra et al., 2020).

1.6 Tri Hita Karana

Tri Hita Karana is the three causes of harmony in life. *Tri Hita Karana* consists of three dimensions, namely: parahyangan, pawongan, and palemahan. Parahyangan regulates the dimension of harmony in human life with God Almighty. Pawongan regulates harmony between fellow humans. While palemahan regulates and maintains a harmonious life with nature or the environment. Research shows that the *Tri Hita Karana* (THK) philosophy increases human capital and has a positive impact on good governance (Artana, 2014). Business sustainability with an ecotourism perspective in Bali is achieved by adopting local cultural values. These local cultural values, known as traditional wisdom, are embedded in the concept of *Tri Hita Karana* (THK).

Palemahan is all forms of good human efforts to realize the harmony of life with the universe and everything in it, while avoiding violations of norms, laws, customs and religious teachings. This dimension focuses on environmental conservation measures, prioritizing ecosystem sustainability and the application of local wisdom principles that are in line with customary law and ecological values (Hutasoit & Wau, 2017). The Palemahan concept taken from *Tri Hita Karana* is the main basis for natural disaster risk reduction in this study. The application of Palemahan concept-based natural disaster risk reduction includes steps such as atmma sradha, manik ring cacupu, and wana kerthi. The understanding of the Palemahan concept is enriched by the addition of traditional ceremonies as a practical implementation and reflection process of Palemahan, as well as the concept of Social Control that aims to create a balance between change and stability in the implementation of disaster risk reduction (Renmaur & Wulolo, 2019).

2. Methods

The research method was conducted with a quantitative approach through a map of the Denpasar City land use research location, followed by a map analyzing land cover, population, tourist attraction and waste generation in Denpasar City. The tools used are the earth map of Denpasar City and Quantum GIS (QGIS) software. This research was also conducted with a literature study through (1) designing the review, (2) conducting the review, (3) analysis, and (4) writing the review (Snyder, 2019). So that the literature study method can strengthen the results of quantitative research with analysis of secondary data.

The research was conducted in four sub-districts in Denpasar City, namely West Denpasar, South Denpasar, East Denpasar, and West Denpasar located between 08 35'31" - 08 44'49" South latitude and 115 10'23" - 115 16'27" East longitude. This location was chosen because it is the capital of Bali Province which is a domestic and foreign tourist destination. This research uses secondary data obtained from various sources.

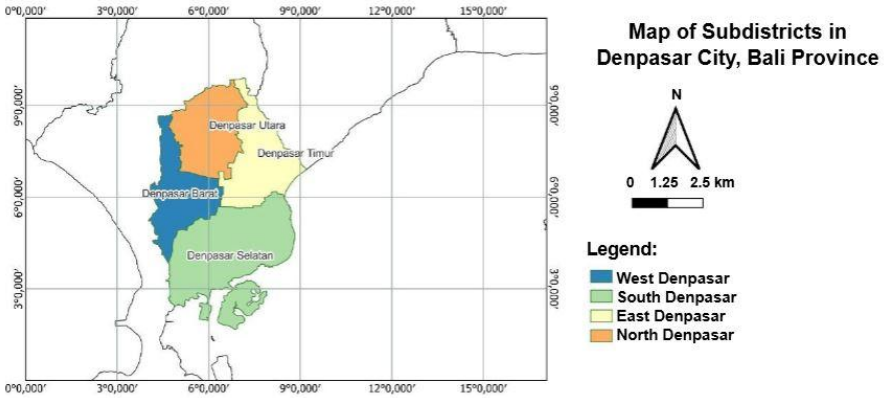


Fig. 1. Map of research location

All spatial data were processed using QGIS software. Spatial data of sub-district maps in Denpasar City were obtained from GADM (GADM. (n.d.). Spatial data of land cover of

Denpasar City, the distribution of tourist attractions in Denpasar City, and the location of Waste Management Sites were obtained from SatuData Denpasar and then used for spatial data analysis in Denpasar City (Denpasar City Government. (n.d.). Data on waste generation in Denpasar City in 2023 was also obtained from Satu Data Denpasar. Statistical data was obtained from the Denpasar City Statistics Agency such as the population projection of Denpasar City in 2020 and the area per sub-district in Denpasar City (Denpasar City Statistics Agency. (n.d.). The data used is the latest data in the research period conducted in 2024.

3. Results and Discussion

3.1 Results of land cover and waste management site analysis

Based on research, it is known that the implementation of waste management based on good environmental governance in Denpasar City has not been effective because there are still many people and businesses that violate or carry out waste management inappropriately so that it pollutes the environment (Negara & Senastri, 2024). This is a highlight because Denpasar City is the capital of Bali Province as well as a tourism city that is famous for its culture.

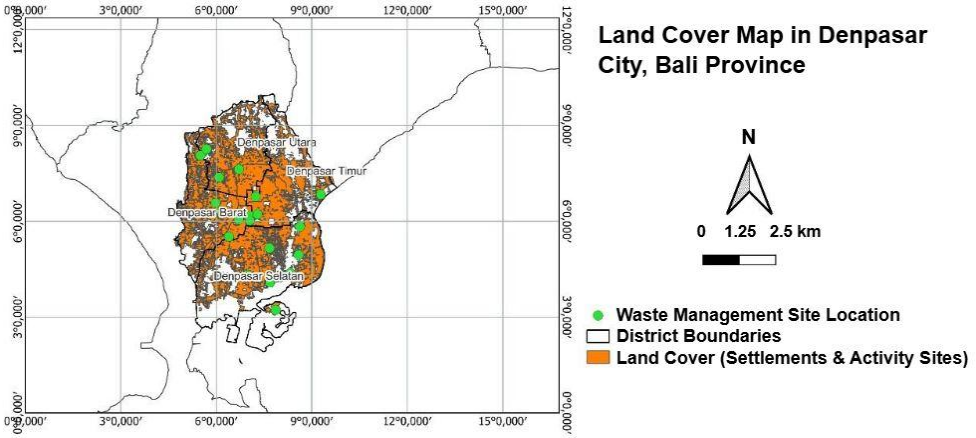


Fig. 2. Land cover map

The presence of tourists is inseparable from the amount of waste generated. Based on the Denpasar City Spatial Plan 2021-2041, it is regulated that the land cover in Denpasar City analyzed in this study is the land cover of Settlements and Places of Activity, the boundaries between sub-districts in Denpasar City and the distribution of Waste Management Sites in Denpasar City which can be seen in Figure 2. The area of Denpasar City is 125.97 km2 or 1,259,700 hectares with a population of 962,900 people so that it has a population density of 32,261 people / km2. Based on data from Satu Data Denpasar shows that the area of organized settlements is 6,841.13 hectares of the total settlement area of 6,866.05 hectares, the percentage of organized settlements in Denpasar City in 2023 is 99.63%. This is in accordance with the land cover map which shows the coverage area covering almost all of Denpasar City.

The next land cover analysis in Denpasar City is Waste Management Sites. Based on data from Satu Data Denpasar in 2022, Denpasar City has 28 TPS3R units and 2 TPST units located in Denpasar City (see Figure 2). Denpasar City has a waste management system that is divided into two such as waste handling and waste reduction. Waste management is carried out in various ways such as Waste Banks, TPST / TPS 3R, Self-management, Reduction Due to Restrictions, Collectors, Composting Houses, Containers, TPS, Street Sweeping, City Parks, Residues (TPS 3R, Self-management, and composting houses), TPST (PPID Denpasar City, 2023). However, the number of facilities provided has not been able

to solve the waste problem in Denpasar City. Waste management does not work optimally because it still leaves the amount of waste unmanaged (Astawa, 2022).

Community-based waste management has low effectiveness because the waste reduction that occurs is only 22.5 percent in one day and the number of people who sort household waste is 44 percent. People are more likely to want the application of the 3R principle in household waste management and consider it important to add supporting facilities for waste management (Dewi et al., 2021). Based on regulations from the Denpasar City Regional Spatial Spal 2021-2041, the realization of the solid waste network system includes: a) waste reduction through limiting waste generation (reduce), recycling waste (recycle); reusing waste (reuse); changing mindsets (reimagine); and changing management design (redesign). Village regulations that regulate mandatory waste segregation at the household level in Padangsambian Village (West Denpasar), improve socialization in the community so that existing information can be properly disseminated (Komang et al., 2022). TPS-3R redesign lies in the community itself, if the community complies with existing regulations and has a high awareness of the consequences of landfilling (Kadek et al., 2023).

3.2 Results of analysis of population and distribution of tourist attractions

Interestingly, South Denpasar Sub-district has the highest projected population in 2020 (hereafter written as population) of 311,590 people with an area of 49.89 km2. Likewise, the number of tourist attractions (DTW) is the highest among the other three sub-districts with 28 units with details of 17 natural DTW units, 9 cultural DTW units and 2 artificial DTW units (see table 4.1.2). In fact, single-use plastic waste is the most common product found, including in tourist attractions. This shows that although various restrictions have been implemented, the impact of reducing single-use plastics has not yet been realized (Hendrawan et al., 2023). Denpasar City has a Mayor's Regulation No. 36 of 2018 concerning Restrictions on the Use of Plastic Bags, this is a form of support for the Bali Governor's Regulation No. 97 of 2018 concerning Restrictions on the Use of Single-Use Plastics (Plastic Bags, Plastic Straws and Styrofoam). In 2023, Denpasar City Regional Regulation No. 8 of 2023 concerning the Implementation of Waste Management has been issued, one of which regulates the community to limit waste generation by not using single-use plastics.

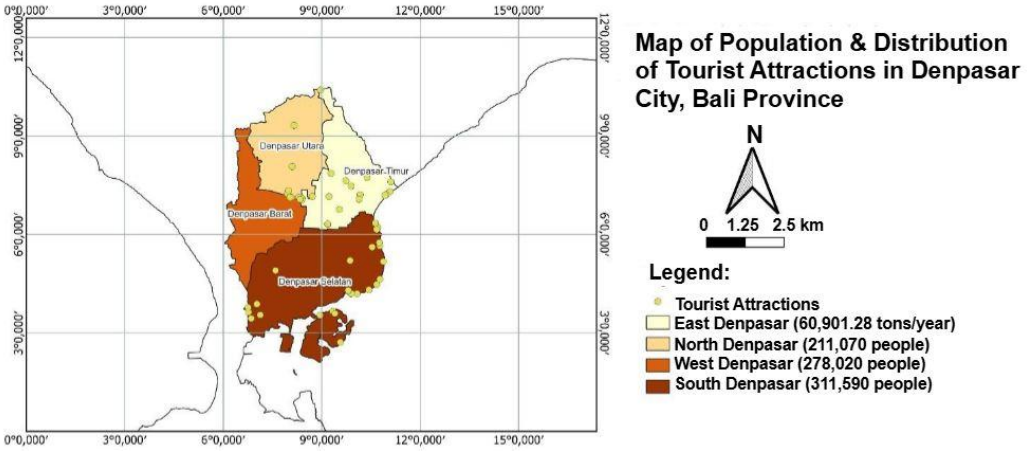


Fig. 3. Map analysis of population and distribution of tourist attractions

Sustainable tourism according to the United Nation World Tourism Organization (UNWTO), one of which must maintain ecological processes and help preserve natural heritage and biodiversity. This is in line with the Global Tourism Plastics Initiative (GTPI) 2022 report which states that tackling plastic pollution in the tourism sector by encouraging companies and destinations to implement sustainable practices such as reuse. This reuse step is also contained in the Regulation of the Minister of Environment and Forestry of the Republic of Indonesia Number P.75/2019 concerning the Roadmap for Waste Reduction by

Producers also emphasizes the importance of reuse to reduce the use of single-use plastics. It is necessary to transition from the linear model of 'take, use, dispose' towards a circular economy framework that is not only about industrial processes, but also consumption habits (Arijeniwa et al., 2024). This solution is expected to be practiced by tourism service providers.

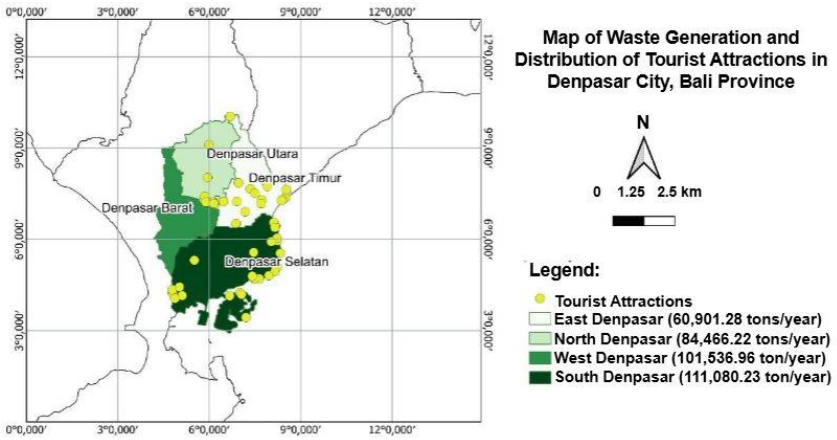
Waste management policies in Denpasar City are very adequate, starting from regulations on the use of plastic bags, sorting of organic and inorganic waste and the formation of waste banks. The success of waste management in Denpasar City, especially household waste, is most determined by the active participation of housewives/PKK (Suryawan et al., 2021). Social interactions have a profound impact on the way people behave in urban spaces. Mainly on humans on how they behave in their personal lives (Askarizad & Safari, 2020). Denpasar City's community interaction is closely related to custom. Thus, the waste problem can be managed independently by the smallest community known as Banjar/Dusun/Lingkungan in the Desa Adat/Administrative Village through the Waste Bank (Suwitra et al., 2020). Data analysis of area, population, population density and waste generation can be seen in Table 1.

Table 1. Data analysis of area, population, population density and waste generation

Sub-district	Area (km^2)	Population (people)	Population Density (people/ km^2)	Waste Generation (ton/year)	DTW (units)
South Denpasar	49.89	311,590	6,246	111,080.23	28
East Denpasar	25.93	162,220	6,256	60,901.28	12
West Denpasar	23.46	278,020	11,851	101,536.96	3
North Denpasar	26.69	211,070	7,908	84,466.22	10
Total	125.97	962,900	32,261	357,984.69	53

3.3 Results of waste generation analysis and distribution of tourist attractions

Based on Table 1, it shows that the waste generated by South Denpasar Sub-district is the highest at 111,080.23 tons/year, although it has the highest population as well, but has the lowest population density. This is because the area of South Denpasar Sub-district is also the highest. When analyzed based on the location of the distribution of tourist attractions, South Denpasar has the most tourist attraction locations in the coastal area. Most of the seasonal waste deposited along the coastline in southern Bali is thought to come from marine debris floating in the Bali Strait (Astawa, 2022). So, there is a way to overcome the waste challenge in this coastal area by recognizing the role and potential with participatory collaborative governance (Pickerill et al., 2024).



Fig, 4. Map of waste generation and distribution of tourist attractions

Based on the map of waste generation and distribution of tourist attractions in Denpasar City above, it should be noted that natural tourist attractions (DTW) are dominated by beaches, irrigation channels (subak) and rivers. In addition, cultural DTWs

are located in Hindu places of worship such as temples. Likewise, artificial DTWs are more towards education such as turtle breeding, introduction to various types of plants and green open spaces such as public squares. These three types of DTWs have shown the application of *Tri Hita Karana* which shows the harmonious relationship between humans with humans (pawongan), humans with beliefs (parahyangan), and humans with their environment (palemahan). Details about the location of the DTWs can be seen in Table 2.

Table 2. Data on tourist attractions in Denpasar City

Sub-district	Natural DTW	Cultural DTW	Artificial DTW
South Denpasar	Sanur Beach, Sunrise Beach, Mertasari Beach, Duyung Beach, Kesumasari Beach, Karang Beach, Shindu Beach, Segara Ayu Beach, Pangembak Beach, Muntig Siokan (Dream Island), Sukamerta Beach, Cemara Alit Beach, Serangan Beach, Mangrove Forest, West and East Subak Intaran, Kerdung Subak, Tukad Badung Dam Estuary	Pura Geriya Tanan Kilap, Pura Luhur Candi Narmada, Pura Dalem Cemara, Pura Sakenan, Le Mayeur Museum, 3D Museum (A Am Bali), Monument of the Balinese People's Struggle, Sindhu Market, Sekaa Barong & Keris Sari Cultural Tourism	Big Garden Corner, Turtle Conservation and Education Center (TCEC)
East Denpasar	Biaung Beach, Kertalangu Cultural Village, Bindu River, Anggabaya Subak Ecotourism, Tangtu Beach	Campuhan Windu Segara Temple, Cultural Park (Art Center), Fingerprint Painting Museum, Barong and Keris Uma Dewi Budaya Group, Barong Eka Budhi Group	Duta Orchid Garden, Kebon Vintage Cars
West Denpasar	Badung River	Badung Market, Kumbasari Market	-
North Denpasar	Sembung Subak Ecotourism	Petilan Pengerebongan Temple, Jagatnatha Grand Temple, Maospahit Temple, Jrokuta Grand Palace, Bali Museum, Catur Muka Statue, Kreneng Market	Lumintang City Park, I Gusti Ngurah Made Agung Field

(Pemerintah Kota Denpasar, 2020)

Based on the results of the above analysis, it is known that Denpasar City has challenges in dealing with the complexities of being a Tourism City. When increasing the number of tourists who come during certain seasons can lead to increased waste generated from accommodation and tourism services (Voukkali et al., 2024). As a city, Denpasar City is required to be able to provide a good and safe space for its citizens. The definition of space in Law No. 32 of 2009 concerning PPLH (article 1) is the unity of space with all objects, forces, conditions, and living things, including humans and their behavior, which affect nature itself, the continuity of life, and the welfare of humans and other living things.

This research discusses a city that pays attention to the human and environmental aspects reflected in the types of natural, cultural and artificial tourist attractions, as well as waste management. These aspects are in line with the *Tri Hita Karana* value embraced by the people of Denpasar City in particular, and Balinese people in general. *Tri Hita Karana* is the three causes of harmony are parahyangan, pawongan and palemahan.

These local cultural values, known as traditional wisdom, are embedded in the concept of *Tri Hita Karana* (THK). Palemahan is all forms of good human effort to realize harmony of life with the universe and everything in it, while avoiding violations of norms, laws,

customs and religious teachings. This dimension focuses on environmental conservation measures, prioritizing ecosystem sustainability and the application of local wisdom principles that are in line with customary law and ecological values (Hutasoit & Wau, 2017). Realizing palemahan should be the focus of Denpasar City because along with the high population growth in the overall settlement area of 6,866.05 hectares, the percentage of organized settlements in Denpasar City in 2023 is 99.63% with the condition of waste management facilities that are not optimal. This can have a negative impact on the sustainability of tourism in Denpasar City.

The behavior of Denpasar City residents is influenced by space and environment. Space is needed for humans to interact socially for their survival. Interaction is one of the five principles of environmental science such as diversity, dependence, harmony and sustainability (Miller & Spoolman, 2016). Palemahan comes from the word lemah (Javanese) which means land. Palemahan also means bhuwana or nature. In a narrow sense, palemahan means the area of a settlement or residence. Humans live in a certain environment, including the city environment. The increasing conversion of land into settlements and places of activity affects the tourist attraction due to the presence of infrastructure (Al shawabkeh et al., 2023). The people of Denpasar City still prioritize preserving natural (24 units) and cultural (23 units) tourist attractions and artificial tourist attractions (6 units) which are scattered in each sub-district.

The implementation of this palemahan value also includes disaster risk reduction, including in this research about waste. The implementation of disaster risk reduction that has the potential to generate waste is based on understanding the concept of traditional ceremonies as a practical implementation and reflection process of palemahan, and the concept of social control that aims to create a balance between change and stability in the implementation of disaster risk reduction (Renmaur & Wulolo, 2019). So, there is a way to overcome this waste challenge by recognizing the role and potential with participatory collaborative governance of the smallest community known as Banjar/Dusun/Lingkungan in Desa Adat/Administrative Village (Suwitra et al., 2020). Urban environments vary widely-as do population sizes, social and economic challenges, community priorities, and levels of autonomy in decision-making (UNEP, 2013). Therefore, Denpasar City can realize sustainable tourism that can have long-term environmental, social, cultural, industrial, and economic impacts for all local communities as well as visiting tourists (Chandradewi et al., 2024).

4. Conclusions

Based on the results of the analysis of the land cover map, population, distribution of tourist attractions and waste generation, it is known that South Denpasar sub-district has the highest area of 49.89 km2, with the highest population of 311,590 people, the highest waste generation of 111,080.23 tons/year and the highest number of DTW 28 units. However, it has the lowest population density among the other three sub-districts. Denpasar City in general has challenges in dealing with the complexity of realizing the Tourism City. The challenges faced by local communities in waste management, the environmental impact of waste that is not managed properly, and the dimensions of the environment (physical, biological and social) can be faced by applying the value of palemahan-a harmonious relationship between humans and the environment. The dense population in Denpasar City, raises other issues that are worthy of future research such as the effect of population and the distribution of tourist attractions on water and air quality, especially in South Denpasar District.

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