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Travel Flow: Digital Solutions to Outgrow the Overtourism in Bali

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Abstract

Bali, as one of Indonesia's premier tourism destinations, continues to face challenges of overtourism, particularly in popular areas such as Kuta, Ubud, and Sanur. This phenomenon has contributed to environmental degradation, declining visitor satisfaction, and limited benefits for local communities. Addressing these challenges requires innovative approaches that balance tourism growth with sustainability. This study evaluates the potential of TravelFlow, a smart-tourism application designed to manage visitor distribution and mitigate overtourism. Using a qualitative approach, data were collected through observations and in-depth interviews with key stakeholders, complemented by Internal–External Factor Analysis (IFAS–EFAS) and SWOT analysis to assess strategic feasibility. The findings reveal three major insights: first, TravelFlow demonstrates strong potential to redirect tourist flows toward alternative destinations, reducing pressure on overcrowded hotspots; second, successful adoption depends on aligning digital solutions with community participation and ensuring adequate infrastructure readiness; and third, integration with sustainable tourism policies is critical to ensure the application's long-term effectiveness. The study highlights that application-based solutions such as TravelFlow can serve as practical tools to foster more balanced tourism development in Bali. By redistributing visitor flows, enhancing environmental responsibility, and promoting community involvement, smart-tourism initiatives hold promise in mitigating the negative impacts of overtourism while supporting a more sustainable and inclusive tourism future.

Keywords: TravelFlow; overtourism; smart tourism; sustainable tourism

INTRODUCTION

Background

Tourism is one of the strategic sectors that contributes significantly to global economic growth (UNWTO, 2023). The contribution as the major of economic development, this sector also creates complex social, cultural, and environmental impacts (Hall & Page, 2014). Based on the Ministry of Tourism and Creative Economy, the number of international tourists that visits to Indonesia increased sharply by 503.34% in January 2022 compared to the same period the previous year (Ministry of Tourism and Creative Economy, 2022). However, in 2023, Indonesia dropped to fifth place as the most popular tourist destination in Southeast Asia, losing to Malaysia, Thailand, Singapore, and Vietnam, with a total of 11.7 million foreign tourist arrivals (CNN, 2024).

Bali, as Indonesia's leading destination, faces significant challenges due to the phenomenon of overtourism in key areas such as Kuta, Ubud, and Sanur (Butler, 2020). These three destinations are the centre of attention for international and domestic tourists because of their unique attractions, ranging from beautiful beaches in Kuta, natural and cultural beauty in Ubud, to the relaxed atmosphere in Sanur (Sudiarta, 2016). However, the high number of tourists visiting this area often causes traffic congestion, environmental damage, and social pressure on local communities (Gössling & Peeters, 2018). These impacts is not only reduce the quality of the tourist experience but also threaten the sustainability of tourism in the area (Dodds & Butler, 2019).

The Bali Provincial Government continues to address these challenges by developing tourism infrastructure and integrating technology into tourism management strategies (Munawwarah, Febridha, & Himawan, 2024). One relevant solution is the application of the smart tourism concept through digital innovation (Buhalis & Amaranggana, 2015). Digital technology enables more efficient tourist management, including distributing visits to alternative destinations, setting quotas at popular tourist locations, and improving the tourist experience through real-time information (Polukhina, Sheresheva, Napolskikh, & Lezhnin, 2025; Wu, Xu, Zhao, Li, & Law, 2024).

Kuta, Ubud, and Sanur have great potential to be optimized through a digital approach. As highly sought-after destinations, these areas require planned management to reduce the negative impacts of overtourism and improve tourism sustainability (Seraphin et al., 2018). Currently, there are still challenges such as the lack of comprehensive digital information about destinations, suboptimal tourist management systems, and minimal diversification of tour packages that promote alternative destinations (Gretzel et al., 2015).

This study will explore the development of the TravelFlow application as a technology-based solution to overcome overtourism in Kuta, Ubud, and Sanur. This application is designed to provide real-time information on destination density levels, recommend alternative locations, and make it easier for tourists to plan their visits (Neuhofer et al., 2015). In addition, TravelFlow will support sustainable tourism management programs by involving local communities and promoting local cultural wisdom (Sigala, 2020).

By utilizing digital technology, this study aims to identify optimal strategies for managing tourism in Bali, especially in the three main destinations of Kuta, Ubud, and Sanur. The results are expected to contribute to the development of a more inclusive, efficient, and sustainable tourism management model, in line with Bali's vision as a world-class, environmentally friendly, and technology-based destination (Karta, Suarthana, Widiastini, & Irwanti, 2024). However, existing research has not sufficiently addressed how application-based tools can be embedded into the governance of overtourism, particularly in balancing

stakeholder interests and ensuring community participation. This creates a research gap in understanding the mechanisms through which digital platforms such as TravelFlow can operationalize sustainable tourism in practice.

LITERATURE REVIEW

The phenomenon of overtourism has become a serious concern in international tourism research. Koens, Postma, and Papp (2018) identified its major consequences, including environmental degradation, social tensions, and a decline in residents' quality of life, underscoring the urgency of addressing this issue in practice. Their findings are particularly relevant to Bali, where destinations such as Kuta, Ubud, and Sanur face tourist numbers that often exceed local carrying capacity, leading to similar socio-environmental pressures.

However, their study remains largely at the macro level, offering limited insight into concrete mechanisms for managing visitor flows within specific destinations an area that requires further exploration. Building on this gap, Seraphin et al. (2018) highlight destination diversification as a practical strategy to reduce excessive tourist concentration. While this approach offers direction for redistributing visitors, it still lacks an operational framework, pointing to the need for digital innovations such as TravelFlow to translate diversification strategies into actionable management tools for Bali.

Sustainable tourism, as introduced by Bramwell and Lane (1993), emphasizes a balanced integration of economic viability, environmental conservation, and sociocultural integrity. While these principles have provided a strong theoretical foundation, practical implementation often falters due to fragmented stakeholder engagement. Dodds and Butler (2019) reinforce that multi-sectoral collaboration is critical, yet the role of digital technology remains underexplored in this discourse.

The TravelFlow application operationalizes these sustainability pillars within Bali's overtourism context through three mechanisms. Environmentally, it mitigates congestion and pollution by redistributing visitors away from saturated hotspots like Kuta, Ubud, and Sanur toward less-crowded sites, thereby reducing peak-hour traffic counts and environmental pressure. Socially, the platform promotes cultural equity by integrating community-managed destinations into tourist itineraries, ensuring that local traditions and village-based tourism enterprises gain visibility.

Economically, TravelFlow stimulates more inclusive growth by dispersing tourist spending across a wider set of destinations, increasing average length of stay (LOS) and distributing occupancy rates more evenly across the island. By aligning visitor flows with the capacity of alternative destinations, the application demonstrates how technology can serve as a concrete mechanism to embed sustainability principles into daily tourism practices.

The development of digital technology brings new opportunities to overcome overtourism. Buhalis and Amaranggana (2015) and Boes et al. (2016) highlight the transformation of destinations into smart destinations through the use of information and communication technology (ICT). Their studies highlight how the integration of technology, such as real-time data and AI-based applications, can improve the efficiency of destination management. These studies provide a strong theoretical foundation, but are still lacking in explaining the long-term effectiveness of technology-based solutions in various cultural and geographical contexts.

In the context of the TravelFlow application, studies by Gretzel et al. (2015) and Femenia-Serra et al. (2019) show the great potential of mobile technology in supporting better tourism experiences and distribution of tourist flows. However, these studies tend to be idealistic and do not sufficiently explore practical barriers such as limited technological infrastructure

in developing destinations. In addition, the literature on specific applications such as TravelFlow is still very limited, so empirical research is needed to evaluate its effectiveness on a wider scale.

Overall, this literature review shows that overtourism and sustainable tourism are interrelated issues, and technology can be a key solution to address these challenges. However, there is a research gap regarding the implementation of effective and sustainable technological solutions, especially in a complex tourism destination like Bali. In this context, smart tourism should not only emphasize technological innovation but also empower communities to collaboratively address the challenges of overtourism (Sarmita & Hu, 2024). An excessive focus on techno-centric approaches risks marginalizing communities, whereas collaboration and collective intelligence are crucial for sustainable destination management. By fostering collaboration that leverages technology acceptance and systems thinking, communities can more effectively mitigate the negative impacts of excessive tourism (Sarmita & Hu, 2024).

METHOD

In this study, the approach used is a qualitative method, which allows researchers to explore the experiences, perceptions, and challenges faced by tourists and local communities related to the phenomenon of overtourism in Bali, especially in Kuta, Ubud, and Sanur. Data collection was conducted during the peak tourist season in July–August 2024 and shoulder season in January 2025, allowing comparisons across different visitor intensities. Direct observations were carried out at major tourist locations such as Jalan Pantai Kuta, Ubud Monkey Forest, Jalan Raya Ubud, Sanur Beach promenade, and the Sindhu harbor area to understand visitor behavior and the environmental impacts caused. The observation protocol included counting pedestrian and vehicle flows at hourly intervals during peak (10:00–12:00; 16:00–18:00) and off-peak hours, noting waste accumulation points, documenting queues at attractions, and recording the presence of informal vendors or street performers.

In addition, in-depth interviews were conducted with various stakeholders, including tourist attraction managers, drivers, and tour guides, to gain deeper insight into challenges in managing visitors. Data were also obtained through documentation studies from various sources, such as official tourism statistics (BPS Bali), previous research reports, and relevant news articles. Data analysis was carried out using descriptive-qualitative techniques to organize and summarize the information obtained, as well as to identify key themes that emerged. Furthermore, Internal Strategic Factors Analysis Summary (IFAS) and External Strategic Factors Analysis Summary (EFAS) were applied to evaluate the strengths, weaknesses, opportunities, and threats faced in tourism management.

To increase the validity of the findings, data triangulation was applied by combining information from observations, interviews, and documentation studies. This study also paid attention to ethical aspects, by obtaining informed consent from respondents before interviews and ensuring the confidentiality of identities and data collected. With this systematic methodological approach, the study provides a credible and contextualized picture of overtourism dynamics in Bali and potential solutions that can be implemented.

RESULTS AND DISCUSSION

The results of the study showed that traffic congestion is one of the main problems caused by overtourism in Kuta, Ubud, and Sanur. In Kuta, congestion occurs almost all day long, especially on main roads such as Jalan Legian, Jalan Pantai Kuta, and the surrounding areas. The high volume of private vehicles and tourist vehicles such as buses and limited parking areas create stagnant traffic conditions. In addition, the high pedestrian activity in areas

adjacent to shopping centres, restaurants, and beaches worsens the situation. This problem has an impact on the experience of tourists who complain about long travel times and discomfort during the trip, as well as disrupting the activities of local communities (BaliPost, 2024).

In Ubud, congestion is very noticeable in the central areas such as Ubud Art Market, Monkey Forest, and the area around Ubud Palace. The roads in Ubud, which tend to be narrow, are unable to accommodate the surge in vehicle volume, especially during the holiday season and weekends. In addition to private vehicles, the large number of tourists using rental cars or online transportation services also contributes to traffic congestion. This condition is exacerbated by the lack of parking zone arrangements and the unavailability of an adequate public transportation system. As a result, tourists and local people often experience delays, while air pollution from motorized vehicles is also a threat to the environment and public health (NusaBali, 2024).

Sanur faces slightly different but still significant challenges. Congestion in this area mostly occurs along Jalan Danau Tamblingan and Jalan By Pass Ngurah Rai, especially in the morning and evening. Limited transportation infrastructure is a major obstacle, with the main roads connecting Sanur to the centre of Denpasar often becoming congested points. In addition, the presence of large tourist buses that transport tourists to Sanur beach often block local traffic. The large number of vehicles parked haphazardly along the beach and near restaurants also causes narrowing of traffic lanes, making the situation worse (Kompas, 2024).

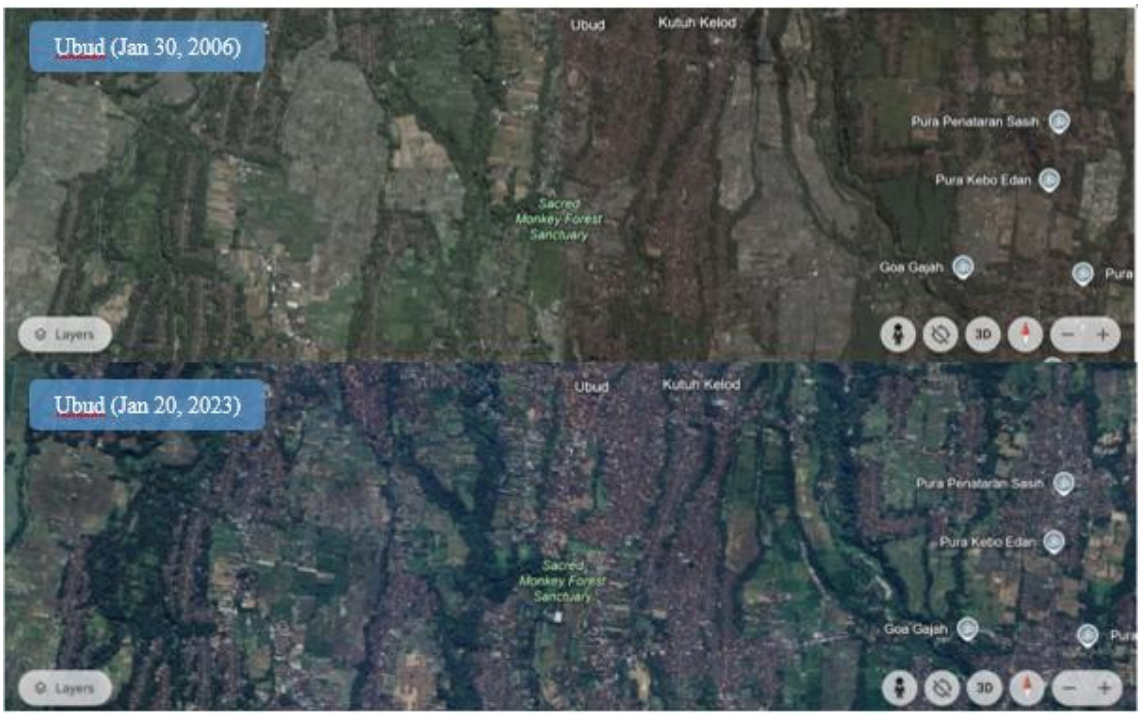

Figure 1. Massive Construction in Ubud
(Sources: Google Maps, imagery from 2006 and 2023)

Congestion caused by overtourism in Kuta, Ubud, and Sanur reduces the comfort of tourists. It also disrupts the productivity of local communities. An integrated solution is therefore required. One option is the development of an environmentally based public transportation system. Another is the implementation of policies restricting tourist vehicles in specific areas. Technology can also be optimized, for

example through traffic management applications to regulate vehicle flow. In addition, road infrastructure should be redesigned to be more pedestrian- and cyclist-friendly as a key mitigation step. The combination of these strategies is expected to create a more sustainable tourism environment and improve the quality of life of local communities (Tempo, 2024).

Further data shows that the number of international tourists to Bali has fluctuated significantly in recent years. The graph below illustrates the trend of the number of tourists to Bali from 2018 to 2023:

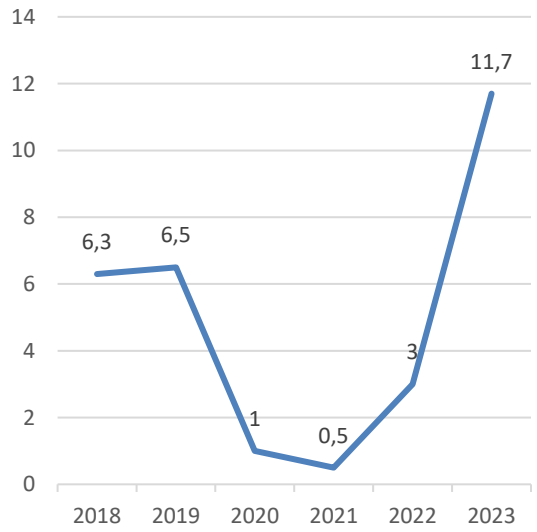

Figure 2. The number of tourists to Bali from 2018 to 2023 (Source: Statistics Indonesia (BPS) – Bali Province, 2024)

The graph indicates a sharp increase in tourist arrivals to Bali in 2022 and 2023. According to BPS Bali (2024), the number of international tourist arrivals grew from 3.0 million in 2022 to 11.7 million in 2023, representing a 290% year-on-year increase. This surge places additional pressure on Bali's infrastructure and environment. The environmental impacts associated with overtourism include higher solid waste volumes, freshwater shortages, and traffic congestion during peak travel periods. Table 1 summarizes the main environmental impacts linked to overtourism in Bali.

Table 1. Environmental Impacts of Overtourism in Bali

No	Types of Impact	Description	Severity Level (1-5)
1	Ecosystem Damage	Degradation of coral reefs and marine habitats due to tourism activities	4
2	Water Pollution	Increased waste and pollution on beaches and rivers	5
3	Traffic congestion	Increased vehicle volume in major tourist areas	4
4	Air Quality Decline	Gas emissions from vehicles and tourism activities	3

Justification of Severity Scoring (1–5):
The scoring scale follows an ordinal severity index, where 1 = very low impact and 5 = very high impact

From this table, it is evident that water pollution (severity level 5) and ecosystem damage (severity level 4) represent the most critical environmental impacts of overtourism in Bali.

Development Strategy

To produce a development strategy to overcome congestion due to overtourism in Kuta, Ubud, and Sanur, a SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis can be used to evaluate internal and external factors that influence the implementation of this system.

Table 2. IFAS Weight, Rating, and Score

Internal Factors		Weight	Rating	Score
No	Strength (S)			
1	Potential for Technological Innovation: The technology-based TravelFlow concept can be utilized to manage traffic flow more efficiently.	0.15	4	0.60
2	Destination Popularity: Kuta, Ubud, and Sanur remain favourite tourist destinations, so there is potential for good acceptance of new solutions.	0.15	4	0.60
3	Awareness of Environmental Issues: Local communities and tourism operators are beginning to realize the negative impacts of traffic congestion, resulting in support for improvement initiatives.	0.10	3	0.30
4	Strategic Location: These three areas have good accessibility from the city centre and the airport, supporting the implementation of a technology-based transportation system.	0.10	3	0.30
				2.10
No	Weakness (W)			
1	Limited Road Infrastructure: Narrow roads and lack of alternative routes are major obstacles to reducing congestion.	0.15	2	0.30
2	Lack of Public Transportation: The dependence of tourists and local people on private vehicles worsens traffic conditions.	0.15	2	0.30
3	Poor Parking Management: The lack of official parking zones and the large amount of haphazard parking causes road narrowing.	0.10	1	0.10
4	Irregularity of Pedestrian Activities: Pedestrian activities in dense areas such as Kuta and Ubud are not balanced with adequate facilities.	0.10	1	0.10
				0.80

Table 3. EFAS Weight, Rating, and Score

External Factors		Weight	Rating	Score
No	Opportunity (O)			
1	Development of Environmentally Friendly Transportation Systems: Shuttle buses or clean energy-based public transportation can be introduced.	0.15	4	0.60
2	Utilization of Digital Technology: Apps like TravelFlow can manage traveller flows, traffic routes, and parking zones more efficiently.	0.15	3	0.45
3	Diversification of Tourist Destinations: Diverting tourists to other areas in Bali could reduce the pressure on Kuta, Ubud and Sanur.	0.15	4	0.60
4	Government Policy Support: The government's efforts to create sustainable tourism open up opportunities for the implementation of long-term solutions.	0.15	3	0.45
				2.10

External Factors		Weight	Rating	Score
No	Threat (T)			
1	Seasonal Tourist Surge: Holiday seasons or certain events can cause surges in tourists that are difficult to manage.	0.10	2	0.20
2	Rejection from Business Actors: Some businesses that rely on high mobility may resist vehicle restrictions or new rules.	0.10	2	0.20
3	Damage to Bali Tourism Image: If the traffic problem is not addressed immediately, tourists may turn to other destinations, reducing Bali's competitiveness.	0.10	2	0.20
4	Environmental Degradation: Air pollution due to congestion has the potential to damage the environment and the quality of life of local communities.	0.10	1	0.10
				0.70

Based on the results of the IFAS and EFAS analysis, the point positions are determined from the total scores of the internal and external factors, and the strategic priorities are then derived in the SWOT Matrix. The total score of the internal factors is 2.10 + 0.80 = 2.90, while the total score of the external factors is 2.10 + 0.70 = 2.80.

Table 4 presents the SWOT Matrix derived from the IFAS and EFAS analyses. The Point Position column shows the coordinates calculated from the total scores of internal factors (Strengths 2.10; Weaknesses 0.80) and external factors (Opportunities 2.10; Threats 0.70). The Area of Matrix indicates the magnitude of each quadrant, obtained by multiplying the respective internal and external scores (e.g., Quadrant I = 2.10 × 2.10 = 4.41).

The Ranking column arranges the quadrants from the highest to the lowest area, reflecting the relative strategic priority. Finally, the Priority Strategy column specifies the strategic orientation appropriate for each quadrant: Quadrant I emphasizes growth and aggressive strategies, Quadrant II prioritizes combination or turnaround strategies, Quadrant III supports stability strategies, and Quadrant IV suggests defensive or shrinkage strategies. The coordinate point (2.90; 2.80), plotted in Quadrant I, confirms that the most relevant priority for Bali's tourism management is an aggressive growth strategy supported by strengths and opportunities.

Table 4. SWOT Matrix

Quadrant	Point Position	Area of Matrix	Ranking	Priority Strategy
1	2.10; 2.10	4.41	1	Growth
2	2.10; 0.70	1.47	3	Combination
3	0.80; 2.10	1.68	2	Stability
4	0.80; 0.70	0.56	4	Shrinkage

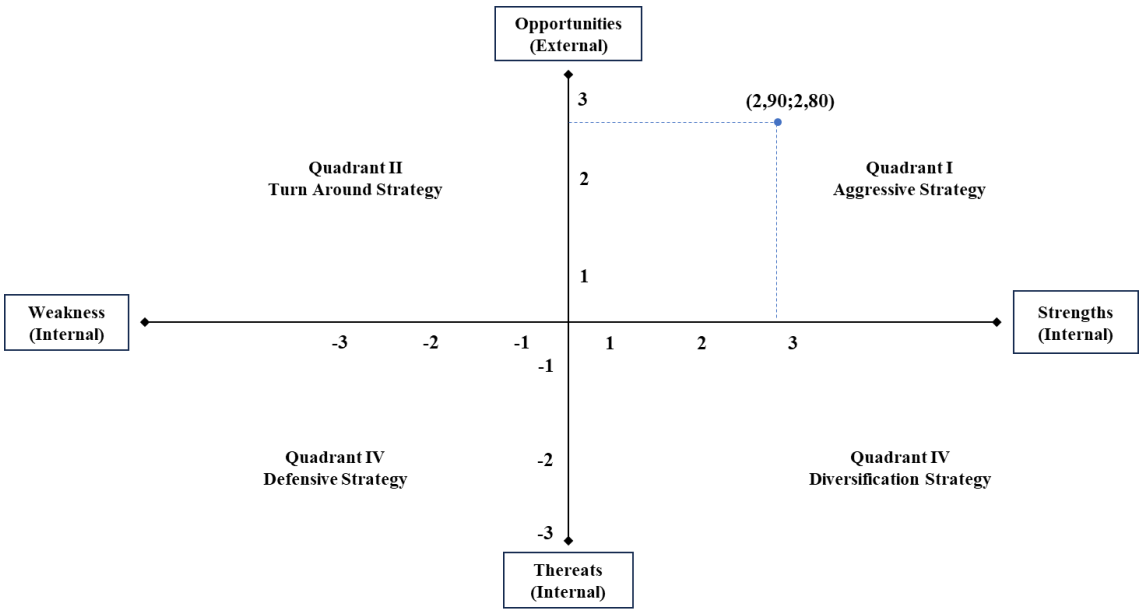

Figure 3. Matric SWOT TravelFlow Digital Solutions to Outgrow the Overtourism in Bali

Based on the SWOT matrix analysis which shows that strengths and opportunities are in quadrant I (Growth), the priority strategy that can be taken is the Stable Growth Strategy. This strategy focuses on gradual development that prioritizes the utilization of existing strengths, while seizing emerging opportunities in the tourism sector. With this approach, tourism development in Kuta, Ubud, and Sanur can be carried out by paying attention to current conditions, with gradual adjustments according to developments in the field.

1. Optimization of Digital-Based Transportation Systems

With the strength of established tourism infrastructure, such as main roads and transportation hubs, and the opportunity for increasing adoption of digital technology in travel management, a traffic and tourist flow management system based on the TravelFlow application is implemented. This application will integrate real-time information on traffic, parking capacity, and alternative route recommendations, so that tourists can be directed to avoid congestion at dense points.

2. Diversification of Tourist Destinations for Tourist Distribution

With the diverse tourist attractions of Kuta, Ubud and Sanur, this strategy leverages the opportunity to promote alternative destinations around the main locations. Tourists are directed to less crowded destinations through digital marketing campaigns and attractive tour package offers, reducing pressure on the main routes.

3. Development of Modern Public Transportation Infrastructure

Leveraging government support for sustainable tourism, the strength of existing infrastructure is enhanced by the development of technology-based public transportation. For example, the addition of environmentally friendly shuttle bus services connected to digital applications to facilitate access for tourists without private vehicles.

4. Data Utilization for Destination Management

With the strength of trained human resources in the tourism sector and the opportunities from the development of big data, the TravelFlow system can use tourist data to predict visit patterns. This allows

for the arrangement of visit times, such as digital reservation systems for major tourist attractions, so that congestion can be minimized during peak hours.

5. Enhanced Collaboration with Stakeholders

With strong local community support and opportunities from the growing global awareness of sustainable tourism, the government is working with local businesses and communities to strengthen community-based tourism management programs. This ensures full support for initiatives to reduce congestion and improve the tourist experience.

TravelFlow Design

The solution to overcome congestion caused by overtourism in Kuta, Ubud, and Sanur can be implemented through the TravelFlow approach, which is a technology-based tourist flow management concept. TravelFlow focuses on monitoring and managing tourist distribution more evenly, efficiently, and sustainably in tourist destinations. This concept involves the use of real-time data and digital-based applications to monitor and manage tourist movements, both on transportation routes and tourist destinations, so as to reduce pressure on certain points that are prone to congestion.

In Kuta, TravelFlow implementation can be done by developing an application that provides information about road capacity and parking areas in real time, as well as directing tourists to use alternative routes or choose less crowded visiting times. With a data-based traffic flow monitoring system, this system can provide recommendations for the best time to visit a particular area, reduce congestion during peak hours, and minimize congestion. For example, tourists who plan to visit Kuta Beach can be guided to come at a quieter time, such as in the morning, or directed to a parking location that is less used but still close to the tourist destination.

In Ubud, TravelFlow can help reduce congestion by monitoring tourist arrivals to key locations such as the Monkey Forest and Ubud Art Market. The app can tell visitors when the best time to visit these places is, as well as provide alternative routes that are smoother. In addition, an environmentally friendly public transportation system, such as a shuttle bus that can be booked through the app, can be introduced to reduce reliance on private vehicles and tour buses. By optimizing the use of scheduled and environmentally friendly public transportation, congestion in the centre of Ubud can be reduced.

For Sanur, TravelFlow can be used to manage traffic flow along Jalan Danau Tamblingan and By Pass Ngurah Rai which are often congested. By using an application that allows tourists to book scheduled parking or private vehicles, congestion can be reduced. In addition, a digital traffic management system integrated with information on road conditions, as well as restrictions on tourist bus operating hours in certain areas, can help reduce traffic congestion caused by large vehicles.

Overall, TravelFlow provides a data and technology-based solution that allows for more efficient monitoring and management of traveler movement, while reducing pressure on existing infrastructure and the environment. With this system, travelers can be directed to visit destinations at less busy times, reducing traffic congestion, and maximizing the travel experience without sacrificing the comfort or sustainability of the tourist destination. The implementation of TravelFlow in Kuta, Ubud, and Sanur is expected to create better managed tourism, reduce congestion, and improve the quality of life of local communities.

TravelFlow is an application-based digital platform that integrates various key features such as travel route management, destination recommendations, public transportation information, reservation systems, and crowd predictions based on real-time data.

The main components of the TravelFlow design include: (1) Tourist Flow Management Dashboard: Provides real-time data for tourism operators and local governments to monitor visitation levels in key destinations such as Kuta, Ubud, and Sanur; (2) Alternative Destination Recommendation System: Directs travellers to less crowded locations through in-app notifications, helping to reduce pressure on prime destinations; (3) Integrated Transportation: Connecting travellers with eco-friendly public transportation services, such as shuttle buses or carpooling, accessed directly through the app; (4) Electronic Reservation and Ticketing System: Manage visiting times to certain destinations to avoid tourist congestion; and (5) Data Analytics and Prediction: Using artificial intelligence to analyze travel patterns and provide policy recommendations based on trends.

TravelFlow has a significant impact on sustainable tourism development in Bali through various innovations. Real-time tourist flow management helps reduce congestion in major tourist areas such as Kuta, Ubud, and Sanur, making travel time more efficient. The reservation and crowd prediction systems implemented are able to maintain destination capacity to match its carrying capacity, protect the environment, and maintain the sustainability of local culture. In addition, integration with environmentally friendly transportation encourages tourists to use public transportation more, which has a direct impact on reducing carbon emissions. TravelFlow also contributes to strengthening local communities by promoting alternative destinations and empowering local communities, creating interactions that strengthen the local economy in a sustainable manner. Tourists also get a better experience through complete and accurate information, more comfortable travel, and easy access to various tourism support services. This makes TravelFlow one of the innovative solutions to support sustainable tourism in Bali.

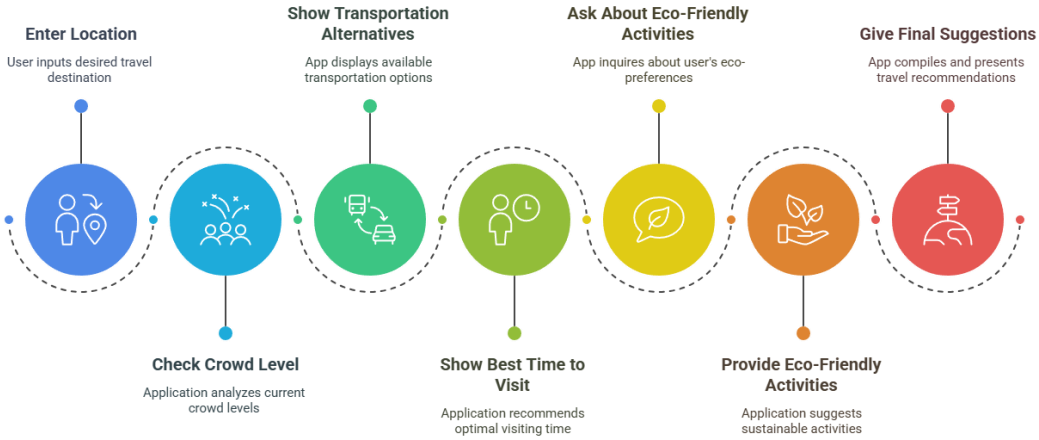

Figure 4. TravelFlow Concept

Legend:

Enter Location	:	users input their desired travel destination.
Check Crowd Level	:	system analyses real-time crowd density at the selected site.
Show Transportation Alternatives	:	application displays available public and private transportation modes.
Show Best Time to Visit	:	system recommends the optimal visiting period to reduce congestion.
Ask About Eco-Friendly Activities	:	application collects user preferences for sustainable tourism options.
Provide Eco-Friendly Activities	:	app suggests low-impact activities aligned with user interests.
Give Final Suggestions	:	platform compiles tailored recommendations integrating travel, time, and sustainability.

TravelFlow offers an innovative solution to address overtourism, there are several challenges that need to be addressed in its implementation. One of the main challenges is the lack of adequate technological infrastructure in some areas of Bali. Some locations may not have stable internet access or the devices needed to use the app, which can hinder the adoption of the technology by tourists and local communities. To address this, the government and stakeholders can work together to improve technological infrastructure, such as providing free Wi-Fi in key tourist areas and ensuring that the app is accessible across a variety of devices.

Another challenge is resistance from tourism industry players who may feel threatened by proposed restrictions, such as visitor quotas at popular locations. To overcome this resistance, it is important to socialize and educate industry players about the long-term benefits of better tourist flow management, including improving the tourist experience and tourism sustainability. Involving tourism industry players in the planning and development process of TravelFlow can help create a sense of ownership and support for the initiative.

CONCLUSION

Congestion caused by overtourism in Kuta, Ubud, and Sanur is a significant problem that threatens the quality of tourist experience and the sustainability of tourism in Bali. Through this study, it was found that the main causes of congestion are the high concentration of tourists in the main destinations, the lack of effective management of travel flows, and the lack of diversification of alternative destinations that can reduce the burden on the main locations. In addition, limited public transportation infrastructure and the lack of technology integration in tourism management worsen the situation.

As a solution, the TravelFlow concept was implemented, a digital platform designed to manage tourist flows in real-time, distribute visits to alternative destinations, and optimize the use of public transportation. With the integration of features such as reservation systems, route recommendations, crowd predictions, and tourist data analysis, TravelFlow is able to significantly reduce congestion while supporting sustainable tourism management.

However, risks must be acknowledged. Business resistance may slow redistribution if operators perceive revenue loss, while a digital divide could exclude older users or communities with limited connectivity. There are also privacy and data governance challenges when handling real-time mobility data.

The study has limitations: the findings rely on a qualitative scope, with possible selection bias in stakeholder interviews, and do not include quantitative testing of user behaviour. Future research should conduct pilot trials and A/B experiments to measure actual shifts in tourist flows, economic impacts on local businesses, and environmental outcomes. This will provide stronger evidence on whether digital crowd-management tools such as TravelFlow can scale sustainably across Bali and other overtourism destinations.

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