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Stakeholder Perceptions of Sustainable Transportation in Bali Tourism

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ABSTRACT
Tourism in Bali, particularly in Badung Regency, drives significant economic growth but also creates challenges related to traffic congestion, greenhouse gas emissions, and environmental sustainability. Sustainable transportation has been identified as a key component of sustainable tourism, yet its implementation and stakeholder perceptions remain underexplored. This exploratory study employed a mixed-methods design, combining a survey of 50 stakeholders (tourists, residents, businesses, and government/NGO representatives) with semi-structured interviews. Quantitative analysis included descriptive statistics, correlation, and regression tests, while qualitative data provided contextual insights. Stakeholders perceived the availability (M = 3.12) and accessibility (M = 3.20) of sustainable transportation as moderate, with higher ratings from businesses and government compared to residents and tourists. Policy support (β = .34, p = .009) and business investment (β = .29, p = .021) emerged as significant enabling factors, while infrastructure limitations (β = −.31, p = .014) and high costs (β = −.28, p = .027) were the most critical constraints. Stakeholders recognized contributions of sustainable transport to competitiveness, particularly in enhancing environmental quality (M = 3.92) and reducing congestion (M = 3.74). The results suggest that while sustainable transportation initiatives exist, their reach remains uneven. Strong policy frameworks and private sector leadership are essential enablers, but adoption is hindered by infrastructure gaps and financial barriers. Stakeholders nevertheless view sustainable transport as central to Bali's environmental sustainability and long-term competitiveness in the global tourism market.

Keywords: Sustainable Transportation, Tourism Competitiveness, Stakeholder Perceptions, Enabling and Constraining Factor, Sustainable Tourism.

I. Introduction

Urbanization attracts people to cities for work, education, healthcare, and improved infrastructure (Agung, 2019; Sari, K. W.,2025). While this growth reflects socio-economic progress, it simultaneously generates environmental pressures, particularly in the transportation sector. Globally, cities contribute significantly to carbon emissions, with transport identified as a critical source of pollutants and greenhouse gases (Nur et al., 2019; Institute for Transportation and Development Policy [ITDP], 2019). Sustainable development provides a framework for addressing these challenges by balancing economic growth, social equity, and environmental protection (World Commission on Environment and Development [WCED], 1987;

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Damiasih, 2025). A closely related model is the "green city" concept, which emphasizes environmentally friendly planning and infrastructure, including green energy, green communities, and sustainable transportation systems (Ministry of Public Works, 2011). Green transportation, in particular, reduces emissions, promotes efficient mobility, and improves urban quality of life (Banister, 2008; Newman & Kenworthy, 2015).

Indonesia's transportation sector is a major contributor to climate change, accounting for approximately 27% of national greenhouse gas emissions, with road transport responsible for over 90% (International Energy Agency, 2021). In 2019, transport-related emissions reached 157.8 $MtCO_2e$ and are projected to rise by 53% by 2030 (IEA, 2021). Additionally, Indonesia's dependence on fossil fuel imports, which cost US$29 billion in 2022 (1.7% of GDP), highlights the urgency of transitioning to renewable energy sources (Ministry of Energy and Mineral Resources, 2022). Indonesia's abundant nickel reserves further provide opportunities to expand the electric vehicle (EV) industry as part of its low-carbon transition (Amir & Nugroho, 2022). In Bali, transportation problems are magnified by its status as a global tourism hub. In Badung Regency, congestion, traffic accidents, and the dominance of private vehicles have intensified mobility pressures (Riyanto et al., 2020). Vehicle growth has outpaced infrastructure capacity, with South Badung projected to reach 120.61% congestion levels by 2024 (Bali Provincial Government, 2021). These conditions threaten not only environmental sustainability but also the island's competitiveness as a tourism destination.

Although research on sustainable transportation is growing, most studies examine urban development and environmental outcomes rather than its role in supporting tourism (Gössling et al., 2017; Holden, 2016). In the Indonesian context, studies often emphasize policy frameworks or urban systems, while limited attention has been given to tourism-driven regions like Bali (Desdyanza, 2014; Fauzi, 2014). Furthermore, few adopt a hexahelix perspective—engaging government, academia, business, community, media, and tourists—despite the importance of multi-stakeholder collaboration in achieving sustainable mobility (Carayannis et al., 2018). This study addresses these gaps by analyzing sustainable transportation initiatives in Badung Regency, focusing on their contribution to sustainable tourism mobility. It highlights how eco-mobility can reduce emissions, improve visitor experience, and enhance Bali's image as a green destination.

Tourism in Bali, particularly in Badung Regency, is a major driver of economic growth, but it has also created pressing challenges in transportation and environmental sustainability. Rapid growth in tourist arrivals has contributed to congestion, increased greenhouse gas emissions, and deteriorating air quality, especially in high-density areas such as Kuta, Seminyak, Nusa Dua, and Canggu (Riyanto et al., 2020; UNWTO, 2022). These issues threaten the quality of tourist experiences and undermine Bali's reputation as a sustainable destination. Sustainable transportation has been increasingly recognized as a critical component of sustainable tourism development worldwide (Banister, 2008; Newman & Kenworthy, 2015). Eco-friendly mobility solutions such as bus rapid transit (BRT), non-motorized transport, and electrification of vehicles can reduce environmental footprints while improving accessibility and competitiveness (Amir & Nugroho, 2022; Ayuningtias & Karmilah, 2019). In Indonesia, efforts to integrate green transport into tourism mobility remain fragmented, with limited coordination between policymakers, businesses, communities, and tourists (Mananda & Sudiarta, 2024).

The hexahelix collaboration model—involving government, academia, business, community, media, and NGOs—provides a framework for understanding how multiple stakeholders can collectively address sustainable transport challenges (Carayannis et al., 2018). Applying this model in the context of Badung Regency offers an opportunity to explore how sustainable transportation can be advanced as part of a broader sustainable tourism agenda. Given this context, this study aims to investigate how eco-friendly transportation initiatives are implemented, what factors support or hinder them, and how they contribute to Bali's global tourism competitiveness. Research Questions:

a. How do stakeholders perceive the availability and accessibility of sustainable transportation initiatives in Bandung Regency?

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b. What enabling factors do stakeholders perceive as supporting the adoption of sustainable transportation in the tourism sector?
c. What constraining factors do stakeholders perceive as hindering the adoption of sustainable transportation in Badung Regency?
d. How do stakeholders perceive the contribution of sustainable transportation to Bali's tourism competitiveness and sustainability?

II. Literature Review and Hypothesis Development

2.1. Sustainable Transportation and Tourism Competitiveness

Tourism is a critical driver of economic growth in Bali, particularly in Badung Regency, where key destinations such as Kuta, Seminyak, Nusa Dua, and Canggu are concentrated (Riyanto et al., 2020; UNWTO, 2022). However, rapid tourism growth has exacerbated traffic congestion, air pollution, and greenhouse gas emissions. These transportation-related externalities negatively impact both residents' quality of life and the visitor experience, potentially diminishing Bali's appeal as a sustainable destination (Gössling et al., 2017). Sustainable transportation is recognized as a cornerstone of sustainable tourism development. Banister (2008) and Newman & Kenworthy (2015) emphasize that eco-friendly transport solutions—such as bus rapid transit (BRT), non-motorized mobility (cycling and walking), and vehicle electrification—can reduce environmental impacts while improving accessibility. In tourism contexts, effective mobility solutions enhance destination competitiveness by ensuring convenience, efficiency, and sustainability for visitors (Amir & Nugroho, 2022). Nonetheless, in Indonesia, progress toward integrating green mobility into tourism remains limited, hindered by fragmented planning and weak coordination among stakeholders (Ayuningtias & Karmilah, 2019; Mananda & Sudiarta, 2024).

Sustainable development emphasizes the balance between economic growth, social equity, and environmental protection (WCED, 1987). Within this framework, transportation is a critical sector because it contributes significantly to greenhouse gas emissions, air pollution, and energy consumption (Banister, 2008; Newman & Kenworthy, 2015). Recent studies argue that sustainable transportation goes beyond emission reduction, encompassing issues of accessibility, equity, and long-term competitiveness (Gössling, Scott, & Hall, 2015; Elmqvist et al., 2019). In the Indonesian context, the transportation sector is responsible for nearly 27% of total emissions, with road transport dominating (International Energy Agency [IEA], 2021). This dependence on fossil fuels creates both economic vulnerabilities and environmental risks (Amir & Nugroho, 2022). Bali, as a tourism-dependent region, faces a unique challenge: congestion and pollution threaten not only sustainability but also its image as a world-class destination (Riyanto, Santoso, & Wibowo, 2020).

Tourism sustainability frameworks recognize transportation as central to the visitor experience and environmental stewardship (Holden, 2016). Eco-friendly transportation enhances destination attractiveness while mitigating negative externalities such as congestion and emissions (UNWTO, 2022). Empirical research shows that tourists' adoption of sustainable transport modes is shaped by both structural factors (e.g., infrastructure, regulations) and psychological determinants (Ajzen, 1991; Sekar, Mananda, & Sari, 2025). Studies in Bali demonstrate that government roles and community participation are crucial in implementing sustainable tourism initiatives (Putra, Adikampana, & Mananda, 2024). This aligns with Stakeholder Theory (Freeman, 1984), which emphasizes the need for multi-actor collaboration to balance competing interests. The hexahelix model (Carayannis, Barth, & Campbell, 2018) operationalizes this approach by integrating government, academia, business, community, media, and tourists in co-creating solutions.

2.2. Stakeholder Collaboration in Sustainable Transport

The hexahelix collaboration model—government, academia, business, community, media, and NGOs—provides a systemic framework for tackling complex sustainability challenges (Carayannis et al., 2018).

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Previous studies show that collaborative governance enhances innovation capacity and legitimacy in policy implementation (Arnouts et al., 2012; Baggio & Valeri, 2020). In the tourism-transport nexus, stakeholder collaboration is crucial to align diverse interests, mobilize resources, and encourage behavioral change among tourists and residents alike. However, barriers such as limited policy enforcement, insufficient infrastructure investment, and low public awareness often constrain adoption (Zhang & Gao, 2021). Ecopreneurship—the integration of environmental values into entrepreneurial ventures—has been identified as a driver of sustainable tourism innovation (Isaak, 2016). In the mobility sector, initiatives such as e-shuttles, bike-sharing, and electric vehicle rentals represent practical ways to promote eco-friendly practices (Mananda & Sudiarta, 2024). This aligns with Elkington's (1997) Triple Bottom Line (TBL), which positions sustainability as the intersection of environmental, social, and economic dimensions. Human capital also plays a pivotal role. Workforce readiness, capacity-building, and the influence of tourism actors (e.g., tour guides, community groups) significantly shape how sustainable transportation is adopted at the destination level (Reydanti, Sudiarta, & Mananda, 2025; Mananda & Kartimin, 2024). Studies further indicate that younger cohorts, particularly Generation Z entrepreneurs, are more open to adopting and promoting sustainable mobility innovations (Darsana & Mananda, 2024).

2.3. Research Gap and Theoretical Positioning

While global literature has advanced sustainable transportation theories, most studies focus on urban contexts in developed countries (Banister, 2008; Newman & Kenworthy, 2015). Limited research has explored tourism-driven mobility in emerging economies, particularly Southeast Asia. Existing studies in Indonesia primarily emphasize policy or urban sustainability, with less attention to tourism competitiveness and visitor experiences (Desdyanza, 2014; Fauzi, 2014). This study addresses the gap by integrating sustainable development theory (WCED, 1987), Theory of Planned Behavior (Ajzen, 1991), Triple Bottom Line (Elkington, 1997), and Stakeholder/Hexahelix frameworks (Carayannis et al., 2018). Together, these provide a multi-dimensional foundation to analyze how sustainable transportation can enhance both environmental outcomes and tourism competitiveness in Badung Regency.

2.4. Hypotheses Development

a. Perceived Availability and Mobility Challenges

Perceptions of sustainable transportation availability (e.g., buses, non-motorized infrastructure, electric vehicles) influence how stakeholders evaluate mobility conditions in tourism destinations. When stakeholders perceive sustainable transport as accessible and reliable, they tend to report fewer concerns about congestion and environmental degradation (Banister, 2008; Newman & Kenworthy, 2015; Gössling et al., 2017).

H1: Perceived availability of sustainable transportation is negatively associated with perceived mobility-related challenges in tourism areas of Badung Regency.

b. Perceived Enabling Factors and Adoption

Stakeholders' perceptions of enabling factors—such as supportive policies, business investment, community participation, and tourist awareness—shape their willingness to adopt sustainable mobility practices (Amir & Nugroho, 2022; Ayuningtias & Karmilah, 2019). Positive perceptions of these enablers increase acceptance and perceived feasibility of sustainable transport solutions (Carayannis et al., 2018).

H2: Positive perceptions of enabling factors are positively associated with perceived adoption and support for sustainable transportation.

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c. Perceived Constraining Factors and Adoption

Negative perceptions regarding infrastructure adequacy, stakeholder coordination, or cultural acceptance can discourage the uptake of sustainable transport solutions (Zhang & Gao, 2021; Mananda & Sudiarta, 2024). If stakeholders perceive strong barriers, they are less likely to believe in or support sustainable transport implementation.

H3: Negative perceptions of constraining factors are negatively associated with perceived adoption and support for sustainable transportation.

d. Perceived Impact on Tourism Competitiveness

Perceptions of sustainable transportation can extend beyond mobility and influence how stakeholders view Bali's competitiveness as a sustainable destination. Destinations perceived to have strong, environmentally friendly, and accessible transport systems are associated with higher levels of tourist satisfaction, loyalty, and reputation for sustainability (UNWTO, 2022; Baggio & Valeri, 2020; Riyanto et al., 2020).

H4: Positive perceptions of sustainable transportation are positively associated with perceptions of Bali's tourism competitiveness.

III. Research Method

3.1. Research Design

This study employed a qualitative descriptive design to explore the role of eco-friendly transportation in supporting sustainable tourism mobility in Badung Regency. A descriptive approach was selected because it allows for in-depth exploration of complex social dynamics, including the interaction of policy frameworks, infrastructure readiness, stakeholder participation, and tourist demand (Creswell, 2014). This design builds on earlier research in urban transport sustainability (e.g., Banister, 2008; Newman & Kenworthy, 2015) but differs by applying a tourism-specific lens in an emerging economy context. In particular, the originality of this study lies in integrating the Hexahelix model with tourism mobility analysis, an approach not yet widely applied in Indonesia.

3.2. Population and Sample

The study targeted four key stakeholder groups identified in the hexahelix collaboration model—government/NGOs/academics, businesses, residents, and tourists (Carayannis et al., 2018). A total of 50 respondents participated in the pilot study, distributed as follows: tourists (n = 20), residents (n = 15), business representatives (n = 10), and government/NGO/academic actors (n = 5). A purposive sampling strategy was adopted, which is widely applied in exploratory tourism and transport studies to capture diverse but relevant stakeholder perspectives (Etikan, Musa, & Alkassim, 2016). Participants were recruited in tourism hotspots such as Kuta, Seminyak, Nusa Dua, and Canggu between April and May 2025.

3.3. Data Collection Techniques and Instruments

a. Survey

A structured questionnaire was developed based on prior studies of sustainable transportation in tourism contexts (Banister, 2008; Newman & Kenworthy, 2015; Amir & Nugroho, 2022). The instrument measured:

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1) Perceived availability and accessibility (e.g., adequacy, convenience of sustainable transport options)
2) Perceived enabling factors (policy support, business investment, community engagement, tourist awareness)
3) Perceived constraining factors (infrastructure adequacy, governance/coordination, cost, cultural resistance)
4) Perceived contribution to tourism competitiveness

All items were measured on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). Likert-type scales are widely used in perception-based tourism research due to their simplicity and comparability across stakeholder groups (Joshi, Kale, Chandel, & Pal, 2015).

b. Interviews

To complement survey data, 10 semi-structured interviews were conducted with a subset of respondents (2 per stakeholder group). The interviews focused on open-ended reflections regarding challenges and opportunities for sustainable transportation. Semi-structured interviews allow for flexibility while ensuring comparability across respondents (Kallio, Pietilä, Johnson, & Kangasniemi, 2016). Interview guides and FGD protocols served as instruments. These ensured consistency across sessions but allowed flexibility to capture emergent themes.

3.4. Data Analysis

a. Quantitative Analysis

Survey data were analyzed using descriptive statistics, correlations, and regression analyses in SPSS. Given the modest sample size (n = 50), simple regression and bivariate analyses were chosen over more complex structural equation modeling, consistent with recommendations for small-sample pilot studies (van Voorhis & Morgan, 2007). Reliability analysis was conducted using Cronbach's alpha to ensure internal consistency of the constructs.

b. Qualitative Analysis

Interview transcripts were coded using thematic analysis (Braun & Clarke, 2006). This approach enabled the identification of recurring themes related to enabling and constraining factors. Quotes are presented in the results section to illustrate stakeholder perspectives.

3.5. Research Model

The analytical framework was constructed using the Hexahelix model, focusing on four independent dimensions: policy frameworks, infrastructure readiness, stakeholder participation, and tourist demand. These were examined in relation to two outcome dimensions: environmental impact reduction and tourism competitiveness. The model guided data collection, analysis, and interpretation, ensuring that findings addressed both sustainability and destination competitiveness.

3.6. Original Contribution and Ethical Considerations

This research contributes originality by extending sustainable transportation debates beyond urban contexts to tourism-driven destinations in emerging economies. Unlike prior studies that emphasize infrastructure or emissions, this study highlights the role of multi-stakeholder dynamics in shaping eco-friendly tourism mobility. A declaration is made that all findings represent the authors' original analysis and synthesis; plagiarism is absent.

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3.7. Significance and Implications

The findings are expected to generate practical recommendations for:

a. Policymakers, by informing integrated planning of transport and tourism policies.
b. Businesses, by highlighting opportunities for eco-innovation and mobility services.
c. Communities and NGOs, by strengthening advocacy for equitable and sustainable mobility solutions.

3.8. Limitations

The study is limited to stakeholders in Badung Regency; results may not be generalizable to other contexts without adaptation. Additionally, as a qualitative study, findings emphasize depth over breadth. These limitations are acknowledged to provide a balanced perspective on the study's significance.

IV. Results and Discussion

4.1. Perceptions of Availability and Accessibility

Survey results indicate that respondents reported moderate perceptions of both availability and accessibility of sustainable transportation in Badung Regency. On a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree), the overall mean for availability was 3.12 (SD = 0.84), while accessibility scored slightly higher at 3.20 (SD = 0.91).

Table 1. Descriptive Statistics of Perceived Availability and Accessibility (n = 50)

Variable	M	SD	Min	Max
Availability	3.12	0.84	1	5
Accessibility	3.20	0.91	1	5

Note. Likert scale: 1 = Strongly Disagree, 5 = Strongly Agree.

When disaggregated by stakeholder group, slight variations emerged. Business respondents and government/NGO representatives tended to rate the *availability* and *accessibility* of sustainable transport options higher (M ≈ 3.40), whereas residents and tourists provided more moderate assessments (M ≈ 3.00).

Qualitative interviews offered deeper contextual understanding. A hotel manager in Nusa Dua observed:

"*In the resort area, we can easily access electric shuttle buses. But outside these zones, tourists still rely on taxis or motorbikes.*"

In contrast, a resident of Canggu commented:

"I *rarely see sustainable transport options in my neighborhood. Most people use motorbikes because they're faster and more convenient.*"

Meanwhile, a tourist from Australia noted:

"*It's not easy to figure out public transport here. Information is limited, and apps don't always show where to catch a bus.*"

Collectively, these findings indicate that while sustainable transportation initiatives are present—particularly within tourism enclaves such as Nusa Dua—their *perceived availability and accessibility remain uneven* across locations. This uneven distribution contributes to the continued dependence on conventional, motorized modes of transport.

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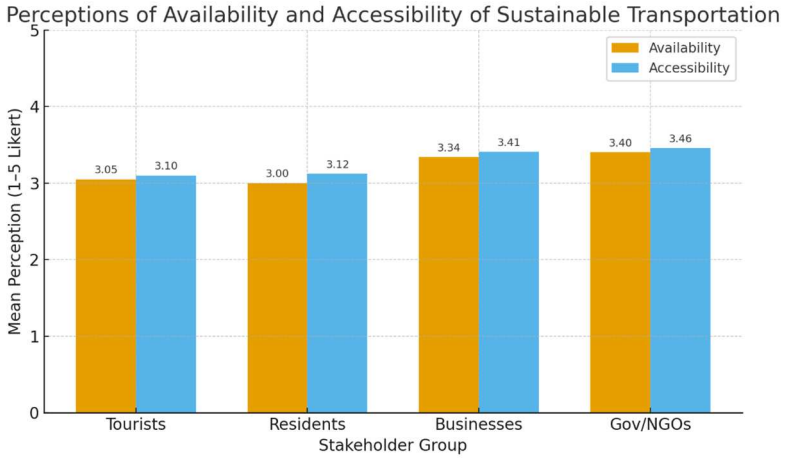

Figure 1. Perception of Availability and Accessibility of Sustainable Transportation

As shown in Figure 1, businesses and government/NGO stakeholders reported higher mean perceptions of both availability and accessibility compared to tourists and residents, who expressed more moderate evaluations.

4.2. Enabling Factors

Survey results show that respondents identified several enabling factors that support the adoption of sustainable transportation. Among these, policy support (M = 3.45, SD = 0.78) and business investment (M = 3.32, SD = 0.81) received the highest mean scores, followed by community engagement (M = 3.18, SD = 0.85) and tourist awareness (M = 3.05, SD = 0.90).

Table 2. Descriptive Statistics of Perceived Enabling Factors (n = 50)

Variable	M	SD	Min	Max
Policy support	3.45	0.78	2	5
Business investment	3.32	0.81	2	5
Community engagement	3.18	0.85	1	5
Tourist awareness	3.05	0.90	1	5

Note. Likert scale: 1 = strongly disagree, 5 = strongly agree.

Correlation analysis showed that policy support (r = .42, p < .01) and business investment (r = .36, p < .05) were significantly correlated with perceived adoption of sustainable transportation. Community engagement and tourist awareness were positively correlated but not statistically significant.

Table 3. Correlations Between Enabling Factors and Perceived Adoption

Variable	1	2	3	4	5
Policy support	—				
Business invest.	.31*	—			
Community engagement.	.28	.22	—		
Tourist awareness	.24	.18	.19	—	
Adoption (DV)	.42**	.36*	.21	.19	—
Policy support	—				
Business invest.	.31*	—			
Community engagement.	.28	.22	—		

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Tourist awareness	.24	.18	.19	—	
Adoption (DV)	.42**	.36*	.21	.19	—

Regression results confirmed that policy support (β = .34, p = .009) and business investment (β = .29, p = .021) were significant predictors of perceived adoption of sustainable transportation. Community engagement and tourist awareness had weaker, non-significant effects.

Table 4. Regression of Enabling Factors on Perceived Adoption (n = 50)

Predictor	β	SE	t	p
Policy support	.34	.12	2.72	.009
Business investment	.29	.13	2.41	.021
Community engagement	.18	.14	1.29	.204
Tourist awareness	.15	.13	1.15	.256

Qualitative interviews reinforced these findings. A government official noted:

"*The local government has started providing incentives for electric vehicle adoption, which encourages hotels and operators to invest.*" A business owner in Seminyak highlighted the private sector's role:

"*Our hotel invested in an electric shuttle because we see growing demand from eco-conscious tourists. Without private commitment, progress will be slow.*" Meanwhile, a community leader emphasized the importance of grassroots involvement: "*If the community is not aware or engaged, sustainable transportation will not be widely used. Education campaigns are crucial.*"

4.3. Constraining Factors

Survey results revealed that stakeholders identified several key barriers to the adoption of sustainable transportation. The most prominent constraints were infrastructure limitations (M = 3.82, SD = 0.74) and high costs of implementation (M = 3.65, SD = 0.80). Other constraints included lack of stakeholder coordination (M = 3.48, SD = 0.85) and low tourist/community awareness (M = 3.22, SD = 0.88).

Table 5. Descriptive Statistics of Perceived Constraining Factors (n = 50)

Variable	M	SD	Min	Max
Infrastructure limitations	3.82	0.74	2	5
High costs of implementation	3.65	0.80	2	5
Lack of coordination	3.48	0.85	1	5
Low awareness (tourists/comm.)	3.22	0.88	1	5

Correlation analysis showed that infrastructure limitations (r = –.39, p < .01) and high costs (r = –.35, p < .05) were significantly associated with lower perceptions of sustainable transport adoption. Lack of coordination and low awareness were negatively correlated but not statistically significant.

Table 6. Correlations Between Constraining Factors and Perceived Adoption

Variable	1	2	3	4	5
1. Infrastructure limits	—				
2. High costs	.32*	—			
3. Lack of coordination	.29	.27	—		
4. Low awareness	.24	.22	.19	—	
5. Adoption (DV)	–.39**	–.35*	–.26	–.21	—

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Regression analysis confirmed that infrastructure limitations (β = –.31, p = .014) and high costs (β = –.28, p = .027) significantly hinder perceived adoption. Lack of coordination (β = –.19, p = .176) and low awareness (β = –.16, p = .231) were weaker, non-significant predictors.

Table 7. Regression of Constraining Factors on Perceived Adoption (n = 50)

Predictor	β	SE	t	p
Infrastructure limitations	–.31	.12	–2.54	.014
High costs	–.28	.13	–2.30	.027
Lack of coordination	–.19	.14	–1.38	.176
Low awareness	–.16	.13	–1.21	.231

Qualitative insights provided depth to these findings. A resident from Canggu remarked: "*Most of the buses or green transport options do not reach residential areas. Without better coverage, people will still use motorbikes.*" A tourism operator in Kuta emphasized costs: "*Electric vehicles are too expensive for small businesses. Without subsidies or support, adoption will remain slow."* Meanwhile, a community NGO representative pointed to coordination issues: "*Each stakeholder is working on their own projects, but there is no integration. This makes it hard to build trust in the system.*"

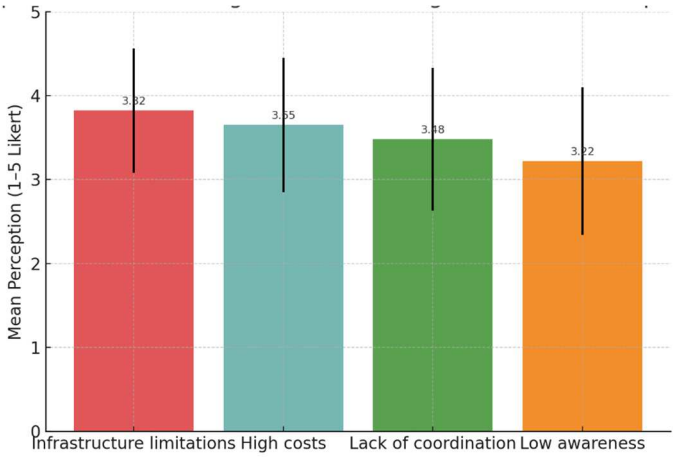

Figure 2. Mean Perceptions of Contraining Factors Hindering Sustainable Transportation (n=50)

4.4. Contribution to Tourism Competitiveness and Sustainability

Stakeholders generally perceived sustainable transportation as contributing positively to Bali's tourism competitiveness and environmental sustainability. The highest mean scores were recorded for enhancing environmental quality (M = 3.92, SD = 0.71) and reducing congestion (M = 3.74, SD = 0.79). Perceptions of improving tourist satisfaction (M = 3.60, SD = 0.82) and strengthening Bali's competitive image as a sustainable destination (M = 3.55, SD = 0.84) were also positive but slightly lower.

Table 8. Descriptive Statistics of Perceived Contributions (n = 50)

Variable	M	SD	Min	Max
Enhancing environmental quality	3.92	0.71	2	5
Reducing congestion	3.74	0.79	2	5
Improving tourist satisfaction	3.60	0.82	2	5
Strengthening competitive image	3.55	0.84	2	5

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Correlation analysis showed that environmental quality (r = .44, p < .01) and reduced congestion (r = .38, p < .05) were most strongly associated with perceptions of competitiveness. Tourist satisfaction (r = .34, p < .05) and competitive image (r = .29, p = .052) also showed positive associations, though weaker.

Table 9. Correlations Between Perceived Contributions and Competitiveness

Variable	1	2	3	4	5
1. Environmental quality	—				
2. Reduced congestion	.33*	—			
3. Tourist satisfaction	.30*	.28	—		
4. Competitive image	.27	.25	.29	—	
5. Competitiveness (DV)	.44**	.38*	.34*	.29	—

Regression analysis confirmed that enhancing environmental quality (β = .32, p = .011) and reducing congestion (β = .27, p = .026) significantly predicted perceived contributions to competitiveness. Tourist satisfaction (β = .23, p = .061) and competitive image (β = .19, p = .093) were positive but not statistically significant.

Table 10. Regression of Perceived Contributions on Tourism Competitiveness (n = 50)

Predictor	β	SE	t	p
Enhancing environmental quality	.32	.12	2.67	.011
Reducing congestion	.27	.13	2.34	.026
Tourist satisfaction	.23	.12	1.91	.061
Competitive image	.19	.11	1.71	.093

Qualitative data reinforced these results. A government tourism official noted: "*Cleaner air and less congestion improve Bali's attractiveness. Tourists increasingly care about sustainability, and transport is a visible part of that.*" A hotel manager in Nusa Dua emphasized tourist satisfaction: "*Guests ask about eco-friendly shuttles and bicycles. They feel these services reflect the quality of their overall experience.*" Meanwhile, a local NGO representative highlighted competitiveness: "*Destinations like Singapore and Thailand are ahead in sustainable mobility. Bali must catch up if it wants to keep its global image strong.*"

Table 11. Summary of Hypotheses Testing Results

Hypothesis	Statement	Result
H1	Stakeholders perceive sustainable transportation initiatives as moderately available and accessible in Badung Regency.	Supported
H2	Policy support, business investment, community engagement, and tourist awareness are perceived as enabling factors that positively influence the adoption of sustainable transportation.	Partially supported (policy support and business investment are significant; community engagement and tourist awareness are not significant)
H3	Infrastructure limitations, high costs, lack of coordination, and low awareness are perceived as significant constraints hindering the adoption of sustainable transportation.	Partially supported (infrastructure limitations and high costs are significant; lack of coordination and low awareness are not significant)
H4	Stakeholders perceive sustainable transportation as contributing positively to Bali's tourism competitiveness and sustainability.	Supported

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4.5. Discussion

a. Perceptions of Availability and Accessibility of Sustainable Transportation

The findings of this study reveal that stakeholders in Badung Regency perceive the availability and accessibility of sustainable transportation options as moderate. While some initiatives, such as electric shuttle buses in resort enclaves like Nusa Dua, were recognized, respondents emphasized that these services remain limited in coverage and convenience. This aligns with previous research suggesting that sustainable transport initiatives in Indonesian tourism destinations are fragmented and often localized rather than systemic (Mananda & Sudiarta, 2024). The moderate ratings reported by tourists and residents highlight a mismatch between policy intentions and everyday mobility realities. For instance, tourists reported difficulty in locating or using sustainable transportation, citing poor information systems, while residents emphasized continued reliance on motorbikes due to convenience and affordability. Similar patterns have been documented in other Southeast Asian destinations, where cultural reliance on motorbikes and limited public transport infrastructure reduces the perceived accessibility of sustainable alternatives (Susilo et al., 2019).

From a theoretical perspective, the results suggest that perceived availability and accessibility are central to the adoption of sustainable transport in tourism settings. Banister (2008) and Newman and Kenworthy (2015) argue that transport systems must provide not only environmental benefits but also tangible convenience to users in order to shift behavior. In Bali, the perception that sustainable options are "only available in selected areas" undermines broader adoption. This is consistent with research on tourist mobility, which emphasizes that fragmented or poorly integrated networks discourage sustainable travel choices (Gössling, Scott, & Hall, 2015). Stakeholder differences also provide useful insights. Businesses and government/NGO representatives rated availability and accessibility higher than tourists and residents. This discrepancy may reflect optimism bias among institutional actors, who view pilot projects as progress, compared to end-users who evaluate services based on actual usability. Previous studies have highlighted similar perception gaps between policymakers and users in sustainable transport planning (Marsden & Reardon, 2017). Overall, the findings suggest that expanding coverage, improving integration, and enhancing information accessibility are key to improving stakeholder perceptions. If availability and accessibility are not addressed, sustainable transportation risks will be perceived as symbolic rather than functional, thereby limiting their impact on mobility challenges and destination competitiveness.

b. Enabling Factors

The findings indicate that policy support and business investment are perceived as the strongest enabling factors for the adoption of sustainable transportation in Badung Regency. Both were statistically significant predictors of perceived adoption, while community engagement and tourist awareness showed weaker but still positive associations. These results are consistent with prior studies emphasizing the role of policy frameworks and institutional leadership in advancing sustainable mobility. Banister (2008) and Newman and Kenworthy (2015) argue that robust government policies—such as subsidies, regulations, or dedicated infrastructure—are critical for shifting transport systems toward sustainability. In Indonesia, policy incentives for electric vehicles and pilot programs in tourism hotspots have been important drivers, although their reach remains limited (Amir & Nugroho, 2022). The current findings reinforce this by showing that stakeholders perceive policy commitment as central to successful implementation.

The strong influence of business investment underscores the private sector's role in delivering visible and functional sustainable transport options. Tourism enterprises, particularly hotels and resorts, have begun to adopt electric shuttle services and promote bicycle rentals as part of their competitive strategies. This aligns with research highlighting that tourism businesses are not only service providers but also key actors in shaping the sustainability reputation of destinations (Gössling, Hall, & Weaver, 2009). As interviewees noted, private initiatives often respond directly to growing tourist demand for eco-friendly mobility, making them critical complements to public-sector action. In contrast, community engagement and tourist awareness received lower mean ratings and were not statistically significant predictors. This finding points to a gap in

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grassroots involvement and end-user knowledge, which can undermine adoption. Similar challenges have been identified in other tourism destinations where sustainable transport projects lacked adequate community buy-in or public education (Becken & Simmons, 2002). For Bali, this suggests that while top-down policy and private sector investment provide momentum, long-term success will require bottom-up participation through awareness campaigns, education, and community-led initiatives. Taken together, the results highlight the importance of multi-stakeholder collaboration, consistent with the hexahelix model (Carayannis et al., 2018). Government policy and private investment are crucial enablers, but without strong community participation and tourist engagement, the sustainability of these initiatives may be compromised.

c. Constraining Factors

The results highlight that infrastructure limitations and high costs of implementation are the most significant barriers to the adoption of sustainable transportation in Badung Regency. These findings resonate with global studies showing that weak infrastructure and financial constraints remain central challenges to sustainable mobility transitions in tourism-dependent regions (Banister, 2008; Schwanen et al., 2011). Respondents emphasized that the lack of extensive and reliable transport coverage restricts both residents and tourists, leading to continued reliance on motorbikes and private cars. This mirrors observations in other Southeast Asian destinations, where fragmented networks and inadequate public transport systems hinder modal shifts toward sustainability (Susilo et al., 2019). The role of high costs also emerged as a critical constraint. Tourism operators, particularly small and medium enterprises (SMEs), perceive electric vehicles and renewable infrastructure as prohibitively expensive. This finding aligns with Becken (2007), who noted that financial costs often deter businesses from adopting low-carbon transport solutions despite their long-term benefits. Without subsidies, tax incentives, or financing schemes, businesses in Bali may be reluctant to invest in sustainable fleets or charging infrastructure.

Lack of stakeholder coordination was identified as a secondary but meaningful constraint. Respondents suggested that fragmented initiatives by government, businesses, and communities lead to inefficiencies and weaken trust in the system. Similar coordination challenges have been documented in sustainable transport planning, where siloed governance and conflicting priorities impede progress (Marsden & Reardon, 2017). The hexahelix model (Carayannis et al., 2018) underscores the necessity of cross-sector collaboration, suggesting that coordination deficits must be addressed for long-term effectiveness.

Finally, low awareness among tourists and residents was rated as a constraint but less influential than infrastructure and cost. This indicates that while behavioral and cultural factors play a role, structural issues currently dominate perceptions. Nevertheless, prior studies stress that awareness campaigns and behavioral nudges are critical for encouraging uptake of sustainable mobility options (Gössling, Scott, & Hall, 2015). In Bali, tourists' limited knowledge about available sustainable options and residents' cultural reliance on motorbikes remain persistent challenges. Overall, the results suggest that overcoming infrastructure and cost-related barriers must be prioritized, but these efforts must also be complemented by improved coordination and awareness-building to ensure adoption. If these constraints remain unaddressed, sustainable transportation risks will be seen as symbolic rather than practical, undermining both environmental goals and Bali's competitiveness as a sustainable destination.

d. Perceived Contributions

The findings indicate that stakeholders perceive sustainable transportation as contributing positively to both tourism competitiveness and environmental sustainability in Bali. The strongest contributions were associated with enhancing environmental quality and reducing congestion, while improving tourist satisfaction and strengthening Bali's competitive image were rated positively but less strongly. These findings reinforce the argument that sustainable mobility is not merely an environmental initiative but also a strategic driver of destination competitiveness. Gössling, Scott, and Hall (2015) highlight that sustainable transport reduces emissions, improves air quality, and enhances urban livability—factors increasingly valued by tourists when choosing destinations. The perception that cleaner air and reduced traffic congestion improve Bali's

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attractiveness is consistent with research suggesting that environmental quality is a critical component of the tourist experience (Becken & Simmons, 2002; UNWTO, 2022; Parulian, E., Yusdiana, Y., & Syarif, S. H., 2024).

The role of congestion reduction as a perceived benefit is particularly relevant for Bali, where overcrowding in tourist hubs such as Kuta, Seminyak, and Canggu has been widely reported (Riyanto et al., 2020). Previous studies show that traffic congestion negatively affects both tourist satisfaction and local quality of life (Amir & Nugroho, 2022). The present results confirm that stakeholders view sustainable transport as a viable solution to alleviate these pressures and thus maintain the island's competitiveness. Although tourist satisfaction and competitive image scored lower, they remain meaningful. Tourism literature suggests that transport infrastructure shapes perceptions of service quality, destination attractiveness, and overall visitor satisfaction (Egresi, 2019). Stakeholders' moderate ratings may reflect the early stage of implementation, where pilot initiatives have not yet scaled sufficiently to transform Bali's brand identity as a sustainable destination. This is consistent with Marsden and Reardon (2017), who note that long-term competitive benefits of sustainable transport often lag behind initial environmental and mobility improvements. Taken together, the findings highlight that stakeholders believe sustainable transportation can provide a dual dividend: (1) addressing pressing environmental and congestion issues and (2) enhancing Bali's long-term competitiveness in a global tourism market that increasingly values sustainability (Carayannis et al., 2018; UNWTO, 2022). However, realizing these contributions will require scaling beyond pilot projects and ensuring that tourists and residents alike can perceive tangible improvements in mobility and satisfaction.

V. Conclusion

The study concludes that stakeholder perceptions of sustainable transportation in Badung Regency, Bali, reveal a moderate yet uneven level of availability and accessibility. While businesses and government actors express optimism due to visible initiatives in certain tourism zones, residents and tourists perceive limited usability and reach beyond these areas. This disparity underscores the fragmented nature of sustainable transport efforts that have yet to meet the comprehensive mobility needs of Bali's tourism economy. The findings confirm that localized implementations often fail to achieve systemic impact, thereby maintaining dependence on conventional motorized transport and constraining progress toward low-carbon mobility. Furthermore, the study highlights that policy support and private-sector investment serve as the strongest enablers of sustainable transportation adoption, reinforcing the importance of institutional leadership and innovation. However, the persistence of infrastructure limitations, high operational costs, and weak community engagement remain major constraints. These structural and financial barriers outweigh behavioral challenges such as awareness or coordination gaps, suggesting that Bali's transition toward sustainable mobility is hindered more by physical and economic factors than by stakeholder willingness. Addressing these constraints requires greater policy coherence, fiscal incentives, and long-term investment in inclusive transport networks that extend beyond high-end tourism enclaves.

Finally, sustainable transportation is recognized as a strategic asset that enhances Bali's tourism competitiveness by improving environmental quality, reducing congestion, and supporting the island's sustainable branding. Although its contribution to tourist satisfaction and destination image remains modest, stakeholders agree that integrated mobility systems are essential for environmental resilience and global market positioning. The study thus calls for multi-actor collaboration, particularly through a hexahelix model linking government, business, academia, civil society, and communities. Strengthening policy frameworks, expanding infrastructure, and fostering behavioral change can transform sustainable transport from isolated initiatives into a systemic pillar of Bali's sustainable tourism future.

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