

A Systematic Review of Habit Formation Processes in Sustainable Travel Behaviour

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ABSTRACT

Sustainable travel behaviour is widely promoted, yet long-term sustainability depends on whether such behaviour becomes habitual. This systematic review examines how sustainable travel practices evolve into stable habits over time. Drawing on 36 empirical studies reviewed using the PRISMA framework, the paper synthesizes evidence across three interacting dimensions: travel motivation, financial factors, and cognitive factors. The findings show that motivation triggers initial engagement, financial feasibility enables continuity, and cognitive alignment supports consistency across repeated decisions. Habit formation emerges through the convergence of these conditions rather than through isolated interventions. The review clarifies how sustainable travel habits develop and highlights implications for research, policy, and practice.

Keywords: Travel Motivation, Comparative Cost, Socio Economic Status, Attitude, Knowledge, Sustainable Travel Behaviour, Habit Formation

INTRODUCTION

Sustainable travel behaviour has become a central concern in tourism and transport research due to its implications for climate change mitigation, environmental degradation, and the long-term sustainability of mobility systems. Travel-related activities contribute substantially to greenhouse gas emissions, congestion, and resource depletion, prompting scholars and policymakers to emphasise behavioural change alongside technological and infrastructural solutions (Gössling & Hall, 2019; Steg & Vlek, 2009). However, growing evidence suggests that durable sustainability outcomes depend not on isolated pro-environmental actions but on the formation of stable behavioural patterns that guide everyday travel decisions. Such stability is best explained through habit formation, whereby repeated behaviours gradually become automatic and less reliant on conscious intention or self-regulation (Wood & Neal, 2007; Verplanken & Wood, 2006; Lally & Gardner, 2013). Consequently, understanding how sustainable travel behaviour develops into habitual practice has become a key objective in behavioural, tourism, and transport research (Hamidi & Zhao, 2020; Gardner et al., 2020).

The literature identifies three broad and interrelated determinants that shape the formation of sustainable travel habits: travel motivations, financial factors, and cognitive factors. Travel motivations initiate behaviour by activating intrinsic and extrinsic drivers such as environmental concern, cultural exploration, leisure,

health, and self-transcendence, which influence individuals' willingness to engage in sustainable travel choices (Deci & Ryan, 2000; Cavagnaro et al., 2021; White et al., 2019). Financial factors, particularly socioeconomic status and comparative cost, condition the feasibility and continuity of such choices by shaping affordability, accessibility, and mode selection, thereby influencing whether sustainable options can be repeatedly adopted over time (Aderibigbe & Gumbo, 2022; Rahat et al., 2024; De Vos et al., 2025). Cognitive factors, including attitudes, knowledge, awareness, and education, further mediate this process by shaping how individuals perceive sustainability and evaluate the consequences of their travel behaviour (Penz et al., 2017; Shareef et al., 2023; Putz et al., 2018). The interaction of these motivational, financial, and cognitive dimensions determines whether sustainable travel behaviour remains situational or evolves into a habitual routine.

While travel motivations, financial factors, and cognitive factors constitute the core mechanisms through which sustainable travel behaviour develops into habits, their application in everyday life increasingly occurs within digitally supported decision environments. In contemporary mobility contexts, AI enabled systems such as travel planning applications, smart mobility platforms, and digital information interfaces can operationalize these determinants in routine travel decisions. Travel motivations may be reinforced through personalized suggestions that align sustainable options with individual preferences and past behaviour, increasing motivational

consistency through repetition (Lehner et al., 2016). Financial considerations related to socioeconomic status and comparative cost can be translated into actionable choices through real-time pricing information, route optimization, and the visibility of cost-efficient sustainable alternatives (Sierzechula et al., 2014; Garcia-Sierra et al., 2015). At the same time, cognitive factors such as attitudes and knowledge may be supported through feedback mechanisms that simplify complex information and visualize environmental impacts, thereby reducing cognitive effort in daily decision making (Penz et al., 2017). In this sense, AI functions as an enabling context that facilitates the practical application of established habit formation processes, rather than as an independent driver of behaviour (Buyalskaya et al., 2023).

Despite extensive research on sustainable travel behaviour and habit formation, existing studies frequently examine travel motivations, financial constraints, and cognitive factors in isolation, resulting in fragmented insights into how sustainable travel habits develop over time. This separation limits a comprehensive understanding of how psychological drivers, economic feasibility, and cognitive evaluation interact to produce stable behavioural routines. Moreover, much of the literature continues to conceptualize habit formation without sufficient attention to the everyday contexts in which travel decisions are repeatedly enacted. Addressing this gap, the present study systematically reviews the literature on habit formation in sustainable travel behaviour, focusing on the interplay of travel motivations, financial factors including socioeconomic status and comparative cost, and cognitive factors. Accordingly, the study is guided by the following research question: How do travel motivations, financial factors, and cognitive factors interact in shaping the formation of sustainable travel habits?

Building on this research question, the paper analyzes how sustainable travel habits are shaped through the interaction of travel motivations, financial factors, and cognitive factors as documented in the existing literature. The primary objective is to clarify the basic mechanisms through which sustainable travel behaviour transitions from intention to habitual practice. In addition, the study briefly discusses how these habit formation processes may be further strengthened in everyday contexts through digitally and AI supported environments that promote repetition and consistency, without positioning AI as a central explanatory element. In doing so, the paper maintains its core contribution as basic research on habit formation while offering contextual insight into how sustainable travel habits may be reinforced under contemporary travel conditions.

THEORETICAL REVIEW

2.1. Travel Motivation

Travel motivation is a fundamental determinant of sustainable travel behaviour because it explains why individuals initially choose environmentally responsible travel options. Intrinsic motivation originates from internal values and personal satisfaction, such as concern for environmental protection, enjoyment of nature, cultural learning, health benefits, and self-transcendence,

all of which have been shown to positively influence sustainable travel intentions and behaviours across different cultural and geographical contexts (Deci & Ryan, 2000; Lee, 2019; Cavagnaro, Staffieri, & Postma, 2021; White et al., 2019; Bhatta et al., 2022). When sustainability aligns with personal identity and moral values, travellers are more likely to select low-impact transport modes, environmentally certified services, and responsible destinations (Penz et al., 2017; Cavagnaro, Staffieri, & Postma, 2021). Extrinsic motivation, in contrast, is primarily shaped by destination-level factors that structure sustainable travel choices, such as sustainability certifications, destination design, and the availability of supportive infrastructure (Penz et al., 2017; Lee, 2019; Di Vaio et al., 2022; Karlsson & Dolnicar, 2016). These external destination attributes encourage sustainable travel behaviour by reducing effort and increasing the feasibility and attractiveness of sustainable options for travellers (Mosca et al., 2024). Together, intrinsic and extrinsic motivations shape sustainable travel behaviour by influencing intention formation, perceived desirability, and willingness to adopt environmentally responsible practices (Dhungana & Sharma, 2024).

While motivation plays a critical role in initiating sustainable travel behaviour, long-term behavioural stability depends on repetition over time. Habit formation theory suggests that behaviours become habitual when they are repeatedly performed in stable contexts, gradually reducing reliance on conscious intention and self-regulation (Wood & Neal, 2007; Lally & Gardner, 2013; Gardner et al., 2020). Intrinsic motivation supports this transition by providing emotional rewards and internal satisfaction that reinforce repeated sustainable travel choices (Verplanken & Wood, 2006; White et al., 2019). Extrinsic motivation can also facilitate habit development, particularly in the early stages, by encouraging repetition through incentives, social reinforcement, or institutional support (Mosca et al., 2024; Sun et al., 2024). As repetition increases, sustainable travel behaviour becomes more automatic and less sensitive to fluctuations in motivational salience (Wood & Rünger, 2016; Zhang et al., 2022). This reflects a pathway in which intrinsic and extrinsic travel motivations initiate sustainable travel behaviour, repeated motivated actions strengthen behavioural consistency, and sustained repetition leads to the formation of sustainable travel habits.

2.2. Financial Factors

Financial factors play a crucial conditioning role in sustainable travel behaviour, with comparative cost and socioeconomic status jointly shaping feasibility, accessibility, and continuity of travel choices (Sierzechula et al., 2014; Aderibigbe & Gumbo, 2022). Comparative cost influences how individuals evaluate sustainable travel options relative to conventional alternatives in terms of monetary cost, time, and convenience. Sustainable options are more likely to be adopted when they are perceived as affordable or cost-competitive, particularly for transport mode choice and destination selection (Sierzechula et al., 2014; Rahat et al., 2024; De Vos et al., 2025). Socioeconomic status further moderates this relationship by shaping access to resources,

infrastructure, and mobility opportunities. Higher income and education levels may enable individuals to absorb higher upfront costs associated with sustainable travel, whereas lower socioeconomic groups may face stronger affordability and accessibility constraints (Aderibigbe & Gumbo, 2022; Mulwa et al., 2022; Kraycheva et al., 2025). Together, comparative cost and socioeconomic status influence whether sustainable travel behaviour is practically achievable and socially accessible.

The influence of comparative cost and socioeconomic status evolves as sustainable travel behaviour is repeated over time. When individuals repeatedly choose sustainable options that align with their economic capacity and perceived value, these choices become familiar and cognitively less demanding (Dijst et al., 2023). Repeated cost-aligned decisions gradually reduce the need for active financial comparison, allowing sustainable travel behaviour to shift from deliberate evaluation to routine action (Garcia-Sierra et al., 2015). Over time, travellers may continue selecting sustainable options even when minor cost fluctuations occur, indicating the emergence of habitual behaviour (Sierzchula et al., 2014; Wang et al., 2025). Socioeconomic stability further supports this process by enabling consistent access to sustainable infrastructure and services. This represents a pathway in which comparative cost and socioeconomic status condition sustainable travel behaviour, repeated economically feasible choices reinforce behavioural patterns, and sustained repetition contributes to the formation of sustainable travel habits.

2.3. Cognitive Factors

Cognitive factors, particularly knowledge and attitude, play a central role in shaping sustainable travel behaviour by influencing how individuals interpret sustainability-related information and evaluate their travel decisions (Penz et al., 2017; Shareef et al., 2023). Environmental knowledge enhances awareness of the consequences of travel behaviour and improves the ability to distinguish between sustainable and unsustainable alternatives (Putz et al., 2018; Kement et al., 2021). Positive attitudes toward sustainability further strengthen this process by fostering moral obligation, environmental concern, and personal responsibility, which are consistently associated with stronger sustainable travel intentions (Penz et al., 2017; Shareef et al., 2023; Spears et al., 2013). However, the literature also documents persistent attitude-behaviour and intention-behaviour gaps, indicating that favourable cognition does not always translate into consistent action (Hibbert et al., 2013; Tolkes et al., 2018; Wut et al., 2023). Despite these gaps, knowledge and attitude remain critical precursors to sustainable travel behaviour.

In the early stages of behaviour change, knowledge and attitude guide conscious decision making, reflection, and learning, making them particularly influential in shaping initial sustainable travel behaviour (Bohte et al., 2009; Kager et al., 2016). As sustainable travel behaviour is repeatedly enacted, reliance on deliberate cognitive processing gradually decreases, consistent with habit formation theory (Wood & Rünger, 2016; Gardner et al., 2020). Nevertheless, cognitive alignment continues to

support habit stability by reinforcing the legitimacy and acceptability of the behaviour, reducing the likelihood of behavioural relapse (Hibbert et al., 2013; Wut et al., 2023). When sustainable travel choices are repeatedly performed in alignment with informed understanding and positive attitudes, they are more likely to become automatic responses to familiar situations (Verplanken & Wood, 2006; Wood & Rünger, 2016). This reflects a pathway in which knowledge and positive attitudes shape sustainable travel behaviour, repeated cognitively consistent actions stabilize behavioural patterns, and sustained repetition leads to the formation of sustainable travel habits.

Overall, the literature indicates that sustainable travel habit formation is a cumulative and reinforcing process shaped by motivational, financial, and cognitive mechanisms. Travel motivations activate initial engagement, comparative cost and socioeconomic status condition feasibility and continuity, and cognitive factors guide understanding and evaluation of behaviour. While each factor contributes independently, their interaction determines whether sustainable travel behaviour is maintained and stabilized over time (Hamidi & Zhao, 2020; Gardner et al., 2020). This integrated conceptualization provides a clear analytical basis for systematically examining how these factors are addressed across empirical studies, thereby informing the methodological approach adopted in the present review.

METHODOLOGY

3.1. Review Design and Framework

This study adopts a systematic literature review design guided by the PRISMA 2020 framework to ensure transparency, consistency, and methodological rigor in synthesizing empirical evidence on sustainable travel habit formation (Page et al., 2021). A systematic review approach was considered appropriate given the fragmented and interdisciplinary nature of research on sustainable travel behaviour, which spans tourism studies, transport research, behavioural science, and sustainability scholarship. While previous studies have examined travel motivation, financial conditions, and cognitive factors independently, an integrated understanding of how these elements jointly contribute to the development of habitual sustainable travel behaviour remains limited. PRISMA is applied in this study as a reporting and screening framework rather than as a methodological theory. It provides a structured process for documenting study identification, screening, eligibility assessment, and inclusion, thereby supporting reproducibility and clarity in the review process (Liberati et al., 2009).

3.2. Eligibility Criteria

Eligibility criteria were defined prior to the search process to ensure consistency and reduce selection bias, in line with established systematic review practices (Liberati et al., 2009; Page et al., 2021). Studies were included if they met the following conditions. First, the study examined sustainable travel behaviour or environmentally responsible travel behaviour within tourism or everyday mobility contexts. Second, the study addressed at least one of the three focal determinants of this review: travel

motivation, financial factors including comparative cost or socioeconomic status, or cognitive factors such as knowledge and attitude. Third, the study incorporated a behavioural dimension related to repetition, routine, or habit formation. Fourth, only peer-reviewed journal articles published in English were included to ensure academic quality and comparability.

Studies were excluded if they focused solely on general travel patterns without a sustainability dimension, examined environmental attitudes without linking them to actual behaviour, or addressed sustainability outcomes unrelated to travel behaviour. Conceptual articles, editorials, conference proceedings, book chapters, and studies lacking sufficient methodological detail were also excluded.

3.3. Information Sources and Search Strategy

A comprehensive literature search was conducted across four major academic databases: Web of Science, Scopus, ProQuest, and PubMed. These databases were selected due to their broad coverage of peer-reviewed literature across social sciences, environmental studies, tourism, transport, and behavioural research (Gusenbauer & Haddaway, 2020). The search was conducted within a predefined time frame to ensure consistency and manageability of results. Search terms were developed based on prior systematic reviews on habit formation and sustainable behaviour and refined iteratively to reflect the objectives of the present study (Wood & Neal, 2007; Gardner et al., 2012; Gardner et al., 2020). Keywords were organised into three thematic clusters:

- (1) sustainable travel behaviour and travel motivation,
- (2) financial factors including comparative cost and socioeconomic status, and
- (3) cognitive factors such as knowledge, attitude, and awareness.

Additional terms related to habit formation, repetition, routine behaviour, and behavioural stability were incorporated to capture the habitual dimension of travel behaviour. Boolean operators were used to combine keywords, and backward reference searching was conducted by screening the reference lists of included studies.

3.4. Study Selection Process

The study selection process followed a structured PRISMA screening sequence (Page et al., 2021). After removing duplicate records, titles were screened to exclude studies that were clearly irrelevant to sustainable travel behaviour or habit formation. Abstracts of the remaining records were then assessed against the predefined eligibility criteria. Full-text articles were retrieved for studies that met the abstract-level screening requirements or where eligibility could not be conclusively determined from the abstract alone.

Only studies that satisfied all inclusion criteria at the full-text stage were retained for final synthesis. The overall study selection process, including identification, screening, eligibility assessment, and final inclusion, is summarized in Figure 1, which presents the PRISMA flow diagram.

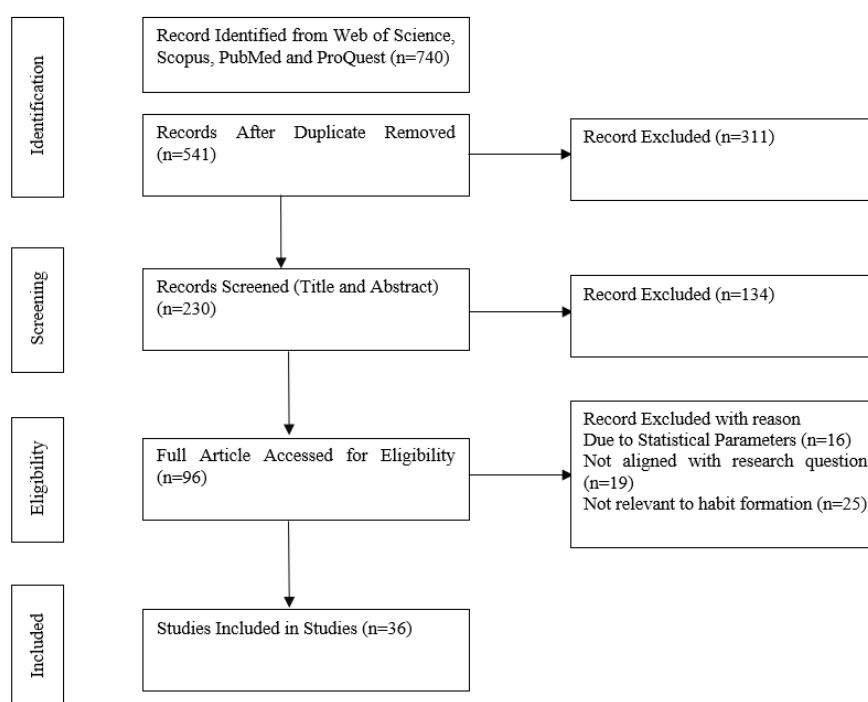


Figure 1: PRISMA Flowchart

3.5. Data Extraction and Synthesis

Data extraction was conducted using a structured and standardized extraction template to ensure consistency across studies (Kitchenham et al., 2009). For each

included study, information was extracted on author(s) and year of publication, geographical context, study design and methodological approach, sample characteristics, key variables related to travel motivation, financial factors, and cognitive factors, and principal findings relevant to sustainable travel behaviour and habit formation.

Given the heterogeneity of study designs, empirical contexts, and measurement approaches, a narrative synthesis was employed rather than a quantitative meta-analysis. Findings were organised thematically according to the three core determinants guiding the review: travel motivation, financial factors, and cognitive factors. This thematic synthesis enabled systematic comparison across studies and facilitated the development of an integrated understanding of how sustainable travel behaviour transitions into habitual practice.

RESULTS

The systematic review resulted in a final sample of 36 empirical studies examining sustainable travel behaviour across tourism and everyday mobility contexts. The reviewed studies span a wide geographical range, including Europe, Asia, Africa, North America, and multi-country settings, and employ diverse methodological approaches such as surveys, regression analysis, structural equation modelling, qualitative

interviews, longitudinal designs, and systematic reviews. Collectively, the literature addresses sustainable travel behaviour through three dominant analytical lenses: travel motivation, financial factors including comparative cost and socioeconomic, and cognitive factors such as knowledge. Together, these studies provide the empirical basis for examining how sustainable travel behaviour is initiated, repeated, and potentially stabilized over time.

4.1. Travel Motivation

The reviewed literature consistently identifies travel motivation as a primary antecedent of sustainable travel behaviour. Early studies emphasise intrinsic motivations, including intellectual curiosity, cultural interest, and experiential engagement, as important drivers of meaningful and responsible travel choices (Pan et al., 2014; Wang et al., 2018). Subsequent research highlights the role of motivational orientation and personal values in shaping preferences for sustainable tourism services and experiences (Penz et al., 2017; Cavagnaro, Staffieri, & Postma, 2021). Empirical evidence further demonstrates that motivation influences satisfaction, attitudes, and future travel intentions, thereby reinforcing sustainable travel behaviour across decision episodes (Lee, 2019; Dhungana & Sharma, 2024).

Table 1: List of Travel Motivation Related Literatures

Reference (Year)	Motivation Focus	Method	Sample / Context	Key Findings	Journal
Pan et al. (2014)	Intellectual and cultural motivation	Critical analysis	145 / USA	Intellectual and cultural motivations are linked to emotionally engaging and meaningful travel experiences.	Tourism Management
De Sá et al., (2025)	Motivation and Travel Mode	Integrated Choice Latent Variable (ICLV) model	1673/ Australia	Trip conditions and duration influence travel time use and planning decisions.	Transportation Research Part A
Wang et al. (2018)	Intrinsic travel motivation patterns	Survey	158 / China	Diverse intrinsic motivations, including health, novelty, and social bonding, underpin travel behaviour.	Tourism Management
Lee (2019)	Motivation and attitude	Empirical modelling	179 / Taiwan	Travel motivation influences satisfaction, which indirectly shapes future travel behaviour.	Leisure Sciences
Cavagnaro et al. (2021)	Self-transcendence motivation	Multivariate analysis	736 / China	Value-driven motivations play a key role in shaping sustainability-oriented travel preferences.	European Journal of Tourism Research
Bhatta et al. (2022)	Travel motivation under crisis	Survey	181 / Nepal	Travel motivation remains a significant driver of travel behaviour even under crisis conditions.	Sustainability

Kim et al. (2024)	General travel motivation	PLS-SEM	5,000 / Korea	Travel motivation shows a strong positive effect on behavioural intention toward emerging travel contexts.	Tourism Review
Dhungana & Sharma (2024)	Motivation and attitude	Descriptive survey	450 / Nepal	Travel motivation significantly affects tourist attitude and travel intention.	Science Journal of Business and Management
Mosca et al. (2024)	Normative motivation	TPB & NAM	467 / Europe	Personal norms and attitudes strongly predict sustainable travel choices.	Transportation Research Part F
Kumar et al. (2024)	Age-based travel motivation	Regression analysis	300 / India	Travel motivations vary across age groups, with younger travellers showing stronger exploratory motives.	Conference Proceedings
Zhao et al. (2025)	Leisure and entertainment motivation	SEM (SOR framework)	527 / China	Leisure-related motivations positively influence sustainable tourism behavioural intention.	Sustainability
Bretter & Pangbourne (2025)	Attitudinal motivation	Survey	1,294 / UK	Attitudinal orientation toward transport modes influences sustainable travel-related emotions and choices.	Travel Behaviour and Society

More recent studies show that motivation remains influential even under constrained or uncertain conditions, such as crises or changing travel environments (Bhatta et al., 2022; Kim et al., 2024). Normative and attitudinal motivations are also shown to play a significant role, with personal norms, attitudes, and emotional responses shaping sustainable travel choices across leisure and transport contexts (Mosca et al., 2024; Bretter & Pangbourne, 2025; Zhao et al., 2025). Across the reviewed studies, travel motivation primarily functions as an initiating mechanism, activating engagement in sustainable travel behaviour. Several studies further indicate that when motivational drivers remain stable across repeated travel decisions, sustainable travel behaviour is more likely to be reproduced in similar contexts, suggesting early conditions for behavioural regularity.

4.2. Financial Factors

Financial factors emerge as key structural conditions influencing sustainable travel behaviour, particularly through comparative cost and socioeconomic status. Early evidence suggests that income and socioeconomic characteristics shape environmentally oriented behaviour indirectly and interact with non-financial determinants (Cottrell, 2003). Subsequent studies emphasise the importance of cost sensitivity, affordability, and bounded rationality in shaping travel decisions, indicating that economic considerations remain central to sustainable travel choices (Garcia-Sierra et al., 2015).

Table 2: List of Financial Factors Related Literatures

Reference (Year)	Financial Factor Focus	Method	Sample / Context	Key Findings	Journal
Cottrell (2003)	Income and environmental knowledge	Multiple regression	201 / Netherlands	Socioeconomic variables show limited direct influence on environmental behaviour, highlighting the mediating role of non-financial factors.	Environment and Behaviour
Garcia-Sierra et al. (2015)	Travel cost and behavioural economics	Conceptual + policy analysis	Global	Travel behaviour is shaped by bounded rationality and cost sensitivity, suggesting that purely economic models insufficiently explain sustainable choices.	Transportation Research Part D
Sierzchula et al. (2014)	Income, education, infrastructure	Multiple regression	14 countries / Global	Socioeconomic conditions, particularly income and infrastructure access, significantly influence adoption of sustainable transport options.	Energy Policy

Vasudevan et al. (2021)	Income and affordability	Regression analysis	1800	Socioeconomic development and income growth are linked to increased tourism activity and financial stability.	Energy Strategy Reviews
Aderibigbe & Gumbo (2022)	Income and age	Survey	495 / Nigeria	Income and age are significant predictors of trip-making behaviour, indicating the role of socioeconomic position in travel frequency.	Urban Planning and Transport Research
Mulwa et al. (2022)	Socioeconomic status	Survey	400 / Kenya	Higher socioeconomic status is associated with more flexible and sustainable urban travel behaviour.	Journal of African Interdisciplinary Studies
Di Vaio et al. (2022)	Socioeconomic context and services	Semi-structured survey	1,180 / Italy	Sustainable service provision at destinations influences tourist satisfaction and perceived value.	Research in Transportation Business & Management
Niu et al. (2020)	Travel cost and accessibility	Heterogeneous analysis	870 / China	Reduced travel costs through infrastructure investment reshape mobility and economic interaction patterns.	Papers in Regional Science
Rahat et al. (2024)	Travel cost and income	Individual Travel Cost Method	211 / Bangladesh	Higher income levels are associated with increased travel frequency, reflecting cost-related constraints on travel behaviour.	Journal of Tourism & Hospitality
Bassey et al., (2024)	Pricing and Financial Incentives	Heterogeneous analysis	Global	Focuses on behavioural and economic factors in smart city technology adoption.	World Journal of Advanced Eng. Tech. & Sciences
Zhang & Ali (2024)	Cost sensitivity and mode choice	Logistic regression	Global	Lower-income households show greater sensitivity to travel costs, influencing mode shift behaviour.	Research in Transportation Economics
Kraycheva et al. (2025)	Socioeconomic disparities	Streetscape audit (MAPS)	Canada	Built environment quality varies across socioeconomic groups, indirectly shaping sustainable mobility options.	Case Studies on Transport Policy

Cross-national and comparative studies demonstrate that income, education, and infrastructure availability significantly influence the adoption and continuity of sustainable transport and travel options (Sierzchula et al., 2014; Niu et al., 2020). More recent research shows that socioeconomic position affects travel frequency, mode choice, and behavioural flexibility, with lower-income groups exhibiting greater sensitivity to travel costs and accessibility constraints (Aderibigbe & Gumbo, 2022; Mulwa et al., 2022; Rahat et al., 2024; Zhang & Ali, 2024). Destination-level service provision and contextual socioeconomic conditions further influence perceived value and satisfaction, indirectly shaping sustainable travel behaviour (Di Vaio et al., 2022; Vasudevan et al., 2021; Kraycheva et al., 2025). Overall, the evidence indicates that financial factors primarily determine the feasibility and continuity of sustainable travel behaviour

and play a critical role in enabling or constraining repeated engagement over time.

4.3. Cognitive Factors

Cognitive factors, particularly knowledge and attitude, play a central role in shaping how individuals interpret sustainability-related information and evaluate their travel decisions. Early qualitative and survey-based studies highlight the influence of attitudes, perceptions, and mobility meanings on travel behaviour and mode choice (Flamm & Kaufmann, 2006; Spears et al., 2013). A recurring finding across the literature is the presence of an attitude-behaviour gap, whereby favourable attitudes toward sustainability do not consistently translate into sustainable travel behaviour (Hibbert et al., 2013; Tolkes et al., 2018).

Table 3: List of Cognitive Factors Related Literatures

Reference (Year)	Cognitive Factor Focus	Method	Sample /	Key Findings	Journal
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			Context		
Spears et al. (2013)	Attitudes and perceptions	Survey	279 / USA	Attitudes toward public transport and safety perceptions significantly influence travel behaviour and mode choice.	Transportation Research Part A
Hibbert et al. (2013)	Attitude–behaviour gap	Narrative analysis	24 / UK	Identity and mobility meanings help explain why positive attitudes do not always translate into sustainable travel behaviour.	Journal of Sustainable Tourism
Flamm & Kaufman (2006)	Mobility perception and attitude	Qualitative study	Switzerland	Perceived freedom and mobility values shape travel-related attitudes and choices in everyday contexts.	Mobilities
Kager et al. (2016)	Social and psychological knowledge	Conceptual analysis	Netherlands	Incorporating subjective knowledge and psychological factors improves understanding of sustainable mode choice.	Transportation Research Part A
Penz et al. (2017)	Attitudes and sustainability labels	Eye-tracking + survey	642 / Austria	Attitudes and awareness of sustainability labels influence preference for certified tourism services.	Sustainability
Putz et al. (2018)	Knowledge acquisition	Longitudinal panel	103 / Austria	Increased knowledge leads to short- and long-term improvements in sustainable transport attitudes and intentions.	Int. Journal of Logistics Management
Tolkes et al. (2018)	Sustainability communication	Semi-structured interviews	20 / Germany	Ineffective communication contributes to the attitude–behaviour gap in sustainable tourism.	Tourism and Hospitality Research
Thigpen (2019)	Skills and attitude change	Survey	1,097 / USA	Experience influences skills and attitudes over time, shaping sustainable cycling behaviour.	Transportation Research Part A
Kement et al. (2021)	Environmental and sustainability knowledge	PLS-SEM	233 / Turkey	Environmental protection knowledge positively influences environmental sensitivity, while general sustainability knowledge shows weaker effects.	Anais Brasileiros de Estudos Turísticos
Shareef et al. (2023)	Attitude–behavioural response	Structural modelling	5,895 / Global	Emotional and psychological aspects of attitude strongly shape tourist behavioural intention during crises.	Journal of Business Research
Wut et al. (2023)	Attitude–intention–behaviour gap	Systematic review	26 studies / Global	Attitude and intention act as mediators, but gaps persist between intention and actual sustainable behaviour.	Sustainability
Zhu et al. (2024)	Non-cognitive attitudes	Survey	318 / China	Non-cognitive attitudinal cues can effectively influence sustainable tourist behaviour in consumption contexts.	Annals of Tourism Research

Empirical and longitudinal studies suggest that increased knowledge can strengthen attitudes and intentions over time, although these effects vary in strength and durability (Kager et al., 2016; Putz et al., 2018; Kement et al., 2021). Experience-based learning and skill development further contribute to attitudinal change and behavioural consistency (Thigpen, 2019). More recent studies emphasise the emotional and psychological dimensions of

attitudes, particularly during periods of uncertainty, and confirm that attitudes and intentions often mediate the relationship between knowledge and behaviour (Shareef et al., 2023; Wut et al., 2023; Zhu et al., 2024). Collectively, these findings indicate that cognitive factors support the evaluation, justification, and stabilisation of sustainable travel behaviour across repeated decision contexts.

Although direct measurement of habit is limited across the reviewed studies, multiple forms of evidence point toward the importance of behavioural repetition as a precursor to habit formation. Several studies report sustained or recurring sustainable travel choices across comparable contexts, such as repeated mode selection, destination preferences, or routine travel patterns, indicating movement beyond one-time behavioural intention (Lee, 2019; Putz et al., 2018; Thigpen, 2019; Mosca et al., 2024). Financial feasibility and stable socioeconomic conditions are frequently associated with continued engagement in sustainable travel behaviour, enabling repetition across time and contexts (Sierchula et al., 2014; Aderibigbe & Gumbo, 2022; Mulwa et al., 2022). Cognitive alignment, particularly consistent knowledge and attitudes, further reduces deliberation in repeated decisions, suggesting early stages of behavioural automatization (Hibbert et al., 2013; Wut et al., 2023). While not all studies explicitly operationalize habit, the recurring emphasis on repetition, routine, and behavioural consistency provides empirical support for understanding sustainable travel behaviour as a process that may gradually transition toward habitual practice.

Taken together, the reviewed literature indicates that sustainable travel behaviour develops through the interaction of motivational, financial, and cognitive mechanisms, with behavioural repetition serving as a key linking process. Travel motivation initiates engagement, financial factors condition feasibility and continuity, and cognitive factors support consistency and justification across similar decision contexts (Pan et al., 2014; Sierchula et al., 2014; Hibbert et al., 2013; Mosca et al., 2024). When these conditions remain aligned over time, sustainable travel behaviour is more likely to be reproduced with reduced deliberation, indicating early stages of habit formation (Cohen et al., 2013). These integrated empirical patterns provide a foundation for examining sustainable travel habit formation as a cumulative and reinforcing process, which is further elaborated in the subsequent discussion.

5. DISCUSSION

5.1. Interpretation of Key Findings

The findings of this systematic review indicate that sustainable travel behaviour is not shaped by isolated determinants, but by a combination of motivational, financial, and cognitive mechanisms that operate at different stages of behavioural development. Across the reviewed studies, travel motivation consistently emerges as the primary trigger that initiates sustainable travel behaviour, particularly through intrinsic drivers such as values, curiosity, and self-transcendence, as well as through normative and attitudinal orientations (Pan et al., 2014; Penz et al., 2017; Cavagnaro et al., 2021; Mosca et al., 2024). These motivational forces are effective in activating initial engagement, but the Results show that motivation alone is insufficient to sustain behaviour over time.

Financial factors, especially comparative cost and socioeconomic status, appear to play a critical

conditioning role by shaping whether sustainable travel behaviour can be repeated and maintained. The evidence suggests that affordability, income, and access to infrastructure influence the feasibility of continued engagement in sustainable travel choices (Sierchula et al., 2014; Garcia-Sierra et al., 2015; Aderibigbe & Gumbo, 2022; Zhang & Ali, 2024). When financial constraints are present, motivated individuals may be unable to translate intention into repeated behaviour, whereas favourable socioeconomic conditions expand the opportunity for continuity and routine formation.

Cognitive factors, particularly knowledge and attitudes, further influence how sustainable travel behaviour is evaluated, justified, and stabilized across repeated decision contexts. The persistence of the attitude–behaviour gap reported in multiple studies indicates that positive attitudes alone do not guarantee consistent behaviour (Hibbert et al., 2013; Tolkes et al., 2018; Wut et al., 2023). However, when knowledge and attitudes remain aligned with sustainable choices, repeated behaviour becomes less deliberative and more consistent (Putz et al., 2018; Thigpen, 2019; Kement et al., 2021). Taken together, the Results suggest that sustainable travel behaviour develops through a layered process in which motivation initiates action, financial conditions enable repetition, and cognitive alignment supports behavioural consistency.

5.2. Sustainable Travel Habit Formation as an Integrated Process

The integrated evidence reviewed in this study indicates that sustainable travel habit formation should be understood as a reinforcing and cumulative process, rather than as a linear sequence driven by a single dominant factor. Across the reviewed literature, sustainable travel behaviour is shaped by travel motivation, financial factors, and cognitive factors, each of which independently contributes to the adoption and continuation of sustainable travel choices. Habit formation does not arise directly from any one of these factors alone but emerges when sustainable travel behaviour is repeated consistently under conditions jointly supported by motivational, economic, and cognitive alignment (Verplanken & Wood, 2006; Wood & R nger, 2016).

Travel motivation contributes to sustainable travel behaviour by influencing willingness, preference, and engagement. Intrinsic motivations such as values, curiosity, and self-transcendence, along with destination-related and normative motivations, are consistently associated with the adoption of sustainable travel practices (Pan et al., 2014; Penz et al., 2017; Cavagnaro et al., 2021; Mosca et al., 2024). At the same time, motivational influences are also shown to interact with contextual conditions, suggesting that motivation alone does not guarantee continuity. Instead, motivation functions as one of several supportive drivers that encourage individuals to choose sustainable options when other enabling conditions are present (Lee, 2019; Bhatta et al., 2022; Kim et al., 2024).

Financial factors, particularly comparative cost and socioeconomic status, independently shape sustainable

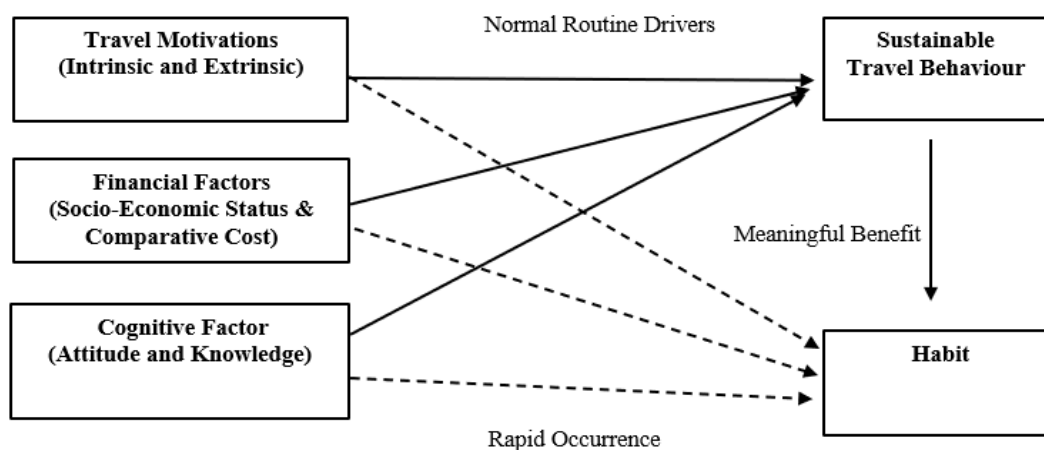
travel behaviour by influencing feasibility, accessibility, and continuity. Empirical evidence demonstrates that affordability and economic capacity affect whether individuals can repeatedly engage in sustainable travel choices across comparable contexts (Sierzchula et al., 2014; Garcia-Sierra et al., 2015; Aderibigbe & Gumbo, 2022; Mulwa et al., 2022). Rather than acting as a secondary or downstream condition, financial factors directly condition sustainable travel behaviour by enabling or constraining repeated enactment. When financial barriers persist, sustainable travel behaviour may remain episodic rather than routine, limiting the potential for habit formation (Zhang & Ali, 2024; Rahat et al., 2024).

Cognitive factors further support sustainable travel behaviour by shaping interpretation, evaluation, and internal consistency across repeated decisions. Knowledge and attitudes influence how individuals process sustainability-related information and assess the desirability of their travel choices (Flamm & Kaufmann, 2006; Spears et al., 2013). While the literature repeatedly identifies an attitude-behaviour gap, it also shows that when knowledge and attitudes remain aligned with

sustainable travel practices, repeated decisions become more consistent and less deliberative (Putz et al., 2018; Thigpen, 2019; Kement et al., 2021). In this way, cognitive factors do not follow sustainable travel behaviour but operate alongside motivational and financial factors to stabilize repeated engagement (Hibbert et al., 2013; Tolkes et al., 2018; Wut et al., 2023).

Taken together, these findings support a conceptualization in which travel motivation, financial factors, and cognitive factors jointly shape sustainable travel behaviour, and where habit formation emerges only when this behaviour is repeatedly enacted under favourable and reinforcing conditions. Habit, in this framework, is not treated as an automatic outcome of motivation or affordability, but as the emergent result of sustained behavioural repetition supported simultaneously by motivational commitment, economic feasibility, and cognitive alignment (Verplanken & Wood, 2006; Gardner et al., 2020). This integrated interpretation emphasises that sustainable travel habits develop through convergence rather than sequence, providing a more accurate representation of the empirical evidence reviewed.

Figure 2: Conceptual Model



Source: Developed based on Deci & Ryan (2000); Verplanken & Wood (2006); Wood & Neal (2007); Sierzchula et al. (2014); Penz et al. (2017); White et al. (2019); Cavagnaro et al. (2021); Gardner et al. (2020); Buyalskaya et al. (2023).

While the proposed pathway (see fig 2) emphasises that sustainable travel habits generally emerge through repeated engagement in sustainable travel behaviour, the reviewed literature also indicates that habit-like responses may occasionally occur rapidly under specific conditions. Strong motivational alignment, immediate financial benefits, or high cognitive readiness can activate pre-existing behavioural scripts or automatic responses, leading individuals to exhibit consistent sustainable travel choices from an initial or early encounter (Wood & Neal, 2007; Gardner, 2015). Examples such as loyalty programmes, default sustainable options, or clearly framed benefits illustrate how motivation, financial incentives, or cognitive clarity may produce behaviour that resembles habit at first touch. However, the literature consistently cautions that such responses are better

understood as habit proxies or rapid routinization, rather than fully consolidated habits, which require continued repetition across stable contexts to become durable and context-independent (Verplanken & Wood, 2006; Gardner et al., 2020).

Importantly, this distinction reinforces the conceptual integrity of the proposed model. Sustainable travel habits do not form automatically through isolated interventions, but through the convergence of motivational commitment, economic feasibility, and cognitive alignment that supports repeated behaviour over time. Recognising the difference between rapid behavioural consistency and stable habit formation provides a critical boundary for interpretation and highlights why short-term behavioural change does not always translate into long-term sustainability. This clarification also points toward the importance of designing supportive environments and interventions that move beyond initial activation to facilitate continued repetition and stabilisation, a consideration that directly informs the practical and policy implications discussed in the following sections.

5.3. Human–AI Supported Strengthening of Sustainable Travel Habits

Recent advances in artificial intelligence have increased the capacity of digital systems to shape everyday decision environments, with implications for how sustainable travel behaviours are supported and repeated. Within the framework developed in this study, AI is not conceptualized as an independent determinant of behaviour, but as a contextual enabler that can reinforce the alignment of travel motivation, financial feasibility, and cognitive consistency. Through personalization, adaptive feedback, and real-time information, AI-enabled systems can strengthen motivational alignment by making sustainable travel options more salient, relevant, and consistent with individual preferences (Thaler & Sunstein, 2008; Caraban et al., 2019). Such reinforcement can help sustain engagement across repeated travel decisions, thereby supporting the conditions under which sustainable travel behaviour may be reproduced over time. Importantly, AI operates by shaping choice architecture and reducing friction between intention and action, rather than by replacing human agency or decision-making (Yeung, 2017).

AI-supported systems also interact with financial and cognitive factors in ways that can facilitate behavioural repetition. From a financial perspective, AI can enhance transparency and perceived affordability through dynamic cost comparison, route optimization, and reward tracking, thereby lowering practical barriers to repeated sustainable travel choices (Ben-Elia & Ettema, 2011; An & Shen, 2025; Rouky et al., 2025). From a cognitive perspective, AI can reduce deliberation costs by simplifying information, providing reminders, and offering consistent feedback, which helps maintain alignment between knowledge, attitudes, and behaviour across similar contexts (Weinmann et al., 2016; Mirsch et al., 2017). In this way, AI strengthens the conditions for repetition that are central to habit formation, without directly producing habits itself. The effectiveness of such systems, however, depends on ethical design, transparency, and inclusiveness, as poorly governed AI may reinforce inequities or undermine trust. These considerations underscore the importance of managerial and policy interventions that ensure AI-supported travel environments contribute to sustained, equitable, and socially responsible habit formation.

5.4. Implications

This study contributes to theory by conceptualizing sustainable travel habit formation as an emergent and reinforcing process shaped by the convergence of motivational, financial, and cognitive conditions, rather than by isolated determinants. By integrating these three domains, the findings extend sustainable travel behaviour research beyond intention-based models and clarify how repeated behaviour under favourable conditions may gradually stabilize into habit. This perspective aligns with and refines habit theory by emphasising that repetition alone is insufficient unless supported by motivational commitment, economic feasibility, and cognitive consistency (Verplanken & Wood, 2006; Gardner et al., 2020). The distinction drawn between short-term

behavioural consistency and fully developed habits further sharpens conceptual boundaries within the habit literature.

From a managerial perspective, the findings suggest that efforts to promote sustainable travel should prioritize behavioural continuity rather than one-time choice modification. Destination managers, transport operators, and service providers can enhance long-term impact by designing travel environments that consistently reinforce sustainable options across repeated encounters. Aligning motivational appeal with affordability and clarity can reduce disruption across travel episodes, increasing the likelihood that sustainable travel behaviour becomes routine. Managers should therefore focus on standardization, predictability, and ease of use to support repetition across similar contexts.

In digital and platform-mediated travel environments, AI-enabled systems offer additional opportunities to strengthen the conditions that support sustainable travel habits. AI can reinforce motivational alignment through personalization and feedback, improve financial feasibility by enhancing cost transparency and incentive visibility, and reduce cognitive effort by simplifying information and supporting consistency across decisions (Thaler & Sunstein, 2008; Caraban et al., 2019). Importantly, AI should be understood as a habit-support infrastructure that facilitates repetition, rather than as a mechanism that directly produces habits. Responsible design that preserves user agency and trust is essential to ensure that AI strengthens, rather than distorts, sustainable travel practices.

At the policy level, the findings highlight the importance of moving beyond awareness-focused interventions toward structural support for repeated sustainable travel behaviour. Policies that address affordability, accessibility, and service continuity are more likely to foster durable behavioural change than those relying solely on information provision or moral appeals. Socioeconomic disparities remain a key barrier to repetition, indicating that equitable pricing, inclusive infrastructure, and consistent service provision are central to enabling sustainable travel habits across diverse populations (Sierzchula et al., 2014; Mulwa et al., 2022).

Finally, as AI increasingly shapes travel decision environments, governance considerations become critical. Transparent algorithms, accountability mechanisms, and safeguards against bias are necessary to ensure that AI-supported travel systems do not reinforce inequalities or undermine autonomy (Yeung, 2017; Floridi et al., 2018). Governance frameworks should emphasise ethical design, inclusivity, and long-term societal outcomes, ensuring that AI contributes to sustainable travel transitions by supporting repeated behaviour without manipulation. Such governance is essential for aligning technological innovation with broader sustainability and public interest goals.

CONCLUSIONS

This study set out to synthesize existing evidence on sustainable travel behaviour through the lens of habit formation, offering an integrated perspective that brings

together motivational, financial, and cognitive factors. By systematically reviewing the literature, the study demonstrates that sustainable travel habits do not emerge from isolated interventions or single determinants, but rather from the repeated enactment of sustainable travel behaviour under reinforcing conditions. Travel motivation supports initial engagement, financial feasibility enables continuity, and cognitive alignment stabilizes repeated choices, together shaping the gradual transition from behaviour to habit. By conceptualizing habit as an emergent outcome of this convergent process, the study provides a clearer theoretical foundation for understanding how sustainable travel practices can become embedded in everyday travel routines, while also situating contemporary digital and AI-enabled environments as supportive contexts rather than primary drivers.

Despite its contributions, this study has several limitations that also point toward directions for future research. As a systematic review, the analysis is constrained by the scope, methodological diversity, and conceptual framing of the existing literature, with many studies inferring habit formation indirectly through behavioural repetition or consistency rather than measuring habit explicitly. Future research could advance this field by employing Exploratory Factor Analysis to empirically examine the underlying structure and interrelationships among motivational, financial, and cognitive dimensions, and to test whether these factors converge into stable latent constructs associated with sustainable travel habit formation. Greater conceptual and measurement clarity in operationalising habit-related constructs would further strengthen empirical progress. Additionally, examining how these factor structures vary across different social, cultural, and infrastructural contexts remains an important avenue for deepening understanding of sustainable travel habit formation..

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