Journal of Infrastructure, Policy and Development 2024, 8(8), 4915.
https://doi.org/10.24294/jipd.v8i8.4915

Review

A conceptual framework for understanding behavioral factors in public transport mode choice in Southeast Asia

Abdul Kafi[1], Izatul Husna Zakaria[1], Abdurrahman Faris Indriya Himawan[2,*], Syaiful Rizal Hamid[3], LF Chuah[1], Norlinda Mohd Rozar[4], Muhammad Ashlyzan Razik[5], Ravi Ramasamy[6]

[1] School of Technology Management and Logistics, Universiti Utara Malaysia, Sintok 06010, Malaysia
[2] School of Economics and Business, Telkom University Bandung, Dayeuhkolot 40257, Indonesia
[3] Faculty of Technology Management and Technopreneurship, Universiti Teknikal Malaysia Melaka, Ayer Keroh 75450, Malaysia
[4] Faculty of Maritime Studies, Universiti Malaysia Terengganu, Kuala Nerus 21030, Malaysia
[5] Faculty Entrepneurship and Business, Universiti Malaysia Kelantan, Pengkalan Chepa 16100, Malaysia
[6] Plexus Manufacturing Malaysia, Bayan Lepas Free Industrial Zone Phase 4, Bayan Lepas 11900, Malaysia
*** Corresponding author:** Abdurrahman Faris Indriya Himawan, farislike@telkomuniversity.ac.id

CITATION

Kafi A, Zakaria IH, Himawan AFI, et al. (2024). A conceptual framework for understanding behavioral factors in public transport mode choice in Southeast Asia. Journal of Infrastructure, Policy and Development. 8(8): 4915. https://doi.org/10.24294/jipd.v8i8.4915

ARTICLE INFO

Received: 29 February 2024
Accepted: 23 April 2024
Available online: 5 August 2024

Abstract: Public transportation is vital for meeting the mobility demands of rapidly expanding Southeast Asian countries. To create effective transportation policies and support sustainable urban movement, it is essential to understand the factors driving individual's choice decisions about transportation modes. This review paper seeks to establish a behavioral theory-based conceptual framework that thoroughly examines and finds the primary influences on individual mode choices within Southeast Asia. We propose a two-stage framework that blends the 'Theory of Planned Behavior (TPB)' with the 'capability, opportunity, and motivation-behavior (COM-B) model'. This synthesis enables the consideration of a broad spectrum of individual-level factors affecting public transport preferences. Ultimately, this review enhances existing knowledge and provides guidance for future research and policy initiatives aimed at fostering sustainable transportation systems across Southeast Asia.

Keywords: behavioral factor; public transport; Southeast Asia; mode choice; TPB; COM-B

1. Introduction

Mode choice is characterized by fare level, trip characteristics, and socio-demographic factors where perception and attitudinal factors influence the choice preferences (Dios et al., 2015). Very deeply, attitudinal statements from passenger perceptions may affect socio-economics and travel behavior of mode choice. Then it could be stated that effective interaction and perception of diversity amongst travelers remain as factors that influence mode choice (Van et al., 2014). While the magnitude of cultural, socio-economic development and the degree of development are differences between Western and Eastern regions. These interventions seem to affect travel attributes that are antecedent to travel behavior, attitudes, intentions, and norms, which are broadly non-generalizable (Van et al., 2014). A close relationship was found where travel time and travel demand studies have gained a prospective future in mode choice studies, which perform a crucial role in the socio-economic growth of any nation (Tsai et al., 2012). Involvement in several countries has revealed that the extent of fares may be a useful tool for encouraging individuals to choose public transport. More specifically unpredictable one-way fare passengers are less conscious of varying in travel fare (Lamondia et al., 2010). In their view, the individual's traveler tends to adopt different cost change techniques. It is likely to vary by the distance of the

journey, destination, travel mode, time paid on traveling, and also the reliability of the journeys (Mohammadzadeh, 2020; Zhou et al., 2024).

In the last few decades, many scholars have intended to establish a feasible travel mode based on significant influencing factors that emphasize the transportation planning sectors. They are in the process of identifying the factors to estimate the features of the built environment such as density location, road network, transit service level, and involvement of employment and business, that related to transit use (Idrisa et al., 2015). Review from behavioral theories will provide the insight that individual's perception and attitude have the capabilities to influence the decision of choice (Ajzen and Fishbein, 2005; Martin Fishbein et al., 2018). Critically reviewed passenger mode choice decision differs in spatial features, such as density and mixed land-use patterns (Rasouli and Timmermans, 2014; Zhu et al., 2023). Therefore, attribute perceptions and travel behavior can reciprocally affect individually. Travel behavior might be the main factor for individual's choice decisions, while an urban structure at the location of residence influences travel behavior (Ashik et al., 2024). Therefore, understanding the factors that affect public transportation mode choice is crucial for the development of effective transportation systems (Banister and Hickman, 2013; Litman, 2008). Numerous studies have emphasized on North America by Frank et al. (2008), and Rodrıguez and Joo (2004). Western Europe and Australia based study was conducted by Eboli and Mazzulla (2009), Schwanen and Mokhtarian (2005), Tsai et al. (2012), and Beirão and Sarsfield Cabral (2007). Studies conducted in the United States, Western Europe, and Australia can provide a significant synergy for Southeast Asian countries. Only a few studies have uncovered the use of public transportation in East and Southeast Asian countries. Thus, the question remains unanswered as to:

RQ1: Do public transport users in Southeast Asian countries exhibit distinct travel behavior patterns that influence their mode choice?

Although, little efforts have been generated by the past studies towards exploring socio-economic and individual's perception on psychological factors with a view of mode choice of travelers. Despite this fact, Idrisa et al. (2015) explored a direct relationship between attitudinal and perception factors and inferred that these situations are more related with mode choice preference. In accordance with this, that physiological factors have a positive relationship based on socio-economic factors with attitudinal perceptions towards vehicle ownership, vehicle availability, travel time, and travel cost with mode choice (Madhuwanthi et al., 2016). Therefore, attribute research focuses more on the attribute perception and travel behavior factors than traditional research in the field of mode choices. Besides, the previous investigations suggested that these cannot be importantly organized to the study of perception based relationships because there is no recommended methodology for investigative differences in attribute perception and travel behavior. Though, current estimations have the effect of adopting a connection of bus service developments approached on travelers' perceptions (Diab and El-Geneidy, 2012; Mahmoud and Hine, 2013).

The results of these arguments have carried out a gap of attribute perception focused on the influential factors towards mode choice of public transport users. There are obvious differences between psychological factors and attribute perception on the understanding of the mode related, in particular, to issues that were incorporating the utility functions for the chosen mode development (Domarchi and Tudela, 2008;

Karimi et al., 2024). A key issue relates to the fact that psychological factors are directly incorporated in most cases without any underlying relation between dummy variables and latent variables (Idris et al., 2015), although several literatures have studied on travel demand and behavior, which is mainly Western-based (Garcia et al., 2009; Steg, 2005). Other researchers have similarly contemplated the case of Southeast Asia (SEA)-based research, which has concentrated to peoples' perception from an instrumental and functional point of view (Soehodho and Rahadiani, 2012).

Rapid urbanization and economic growth in Southeast Asia have led to significant changes in transportation patterns (Ou et al., 2022). Understanding mode choice behavior, the way individuals select their mode of travel (car, motorbike, bus, etc.), is crucial for sustainable urban development (Venter et al., 2019). However, existing research often overlooks the unique characteristics of the region (Loo et al., 2015). This review explores the specific challenges and factors influencing mode choice in Southeast Asian countries. A key challenge lies in the dominance of motorcycles. While offering affordability and convenience, motorcycles contribute to congestion and air pollution (Zhou et al., 2024). Studies like Azhar and Mohd Zahari (2022) highlight this challenge and the need for alternative solutions. Another characteristic feature is the predominance of informal transit, including paratransit services like motorcycle taxis and jeepneys (Jeep). Research by Phun et al. (2018) examines how these options influence travel behavior alongside formal public transport systems. Beyond traditional factors like travel time and cost, psychosocial aspects also play a significant role. Research by Guo et al. (2020) explores how perceptions of comfort, safety, and social status can influence mode choice. This review highlights the need for a nuanced understanding of mode choice behavior in Southeast Asia. By considering the region's specific challenges and characteristics, policymakers can develop more effective strategies to promote sustainable and equitable transportation systems.

Hence, in order to address the associated challenges and deficiencies, this research aims at developing an integrative framework for travelers' mode choice in the context of attribute perception factors by adopting COM-B model (Michie et al., 2011). This is an important effort to fill the existing gap for the policy makers to design effective choice model for public transport use in the future.

The paper is structured as follows: Section two provides a brief overview of the theoretical foundation by outlining theories related to travel behavior, which enables an understanding of the factors influencing travel behavior. Next, we develop a study approach to answer the research question. In the fourth section, we present a conceptual framework for the role of COM-B factors in travel mode choice towards public transport use. The fifth section presents an integrative conceptual framework that links the results of the literature review in detail. The sixth section provides findings and policy implication strategies. Finally, the conclusion of this study is discussed.

2. Theoretical foundation

Underpinning theories

Over the past decade, the most challenging task has been to decrease private care

dependency and increase public transport use. Several behavioral theories have been developed, specifically, the Norm Decision-making Model (NDM) another name Norm Activation Model (NAM) (Schwartz and Howard, 1981), Theory of Comprehensive Action Determination Model (CADM) (Klöckner and Blöbaum, 2010) and Theory of Planned Behavior (TPB) (Ajzen, 1991). Among these theories, TPB is extensively employed in transport studies to investigate the impact of interferences on travel behavior change (Donald et al., 2014; Lai and Chen, 2011; Thorhauge et al., 2016). But this literature has some limitations of research addressing the difficulties faced by personal characteristics and external conditions when applied to travel behavior studies. The above issues determined by Michie et al. (2011) and managed him to propose the COM-B model for effecting behavioral change. This perspective integrates COM-B and TPB to suggest a mode choice model. This study is structured toward TPB and COM-B model. Therefore, this study conceptualizes the attribute perception of travelers as well as their mode choice behavior. The theory and model adopted have been applied in the understanding of how travel attribute perception factors affect the traveler mode choice behavior on public transport use. Both theory and model have been explained in great depth in the following section.

TPB contemplates that the conceptualization of the behavioral decision comprises three attributes which are, relying on the peoples' attitude, subjective norms, and perceived behavioral control (Ajzen, 1991). The theory explains that human behavioral intention strength is the primary determinant to support behavioral concept (Kaewkluengklom et al., 2017). While a significant amount of literature has been published on the processes related to building up a relationship between attitudes and behavioral intentions, the individual shape TPB has made it probable to clarify the choice of travel mode regarding the relative impact. The attitude and subjective norms and the high perceived behavioral control in the predictions are expected to change behavioral positions where attitudes are normative and robust impact is more dominant. In a behavior study, Loo et al. (2015) highlighted that the three factors are reasoned with TPB, attitude towards behavior has a significant influence (for example, in the two Dutch regions of Zuid-Holland and Limburg, the majority of people intend to travel by car); students' mode choices in six Asian countries (Van Cranenburgh et al., 2014); departure time choice of flexible working time car commuters in Copenhagen (Thorhauge et al., 2016). Bamberg et al. (2010) found the perceived behavioral control and attitude expected intention to use a bus, which intention affected choice behavior. Perceived behavioral control also has essential effects on behavioral intention towards future sky train usage in Phnom Penh (Long et al., 2011); and intention to use a motorbike in Taipei and Kaohsiung cities in Taiwan (Chen and Lai, 2011). Besides, discovered that the subjective norm is that the most influential factor of intention to change from private vehicles to public transport. In parallel to the TPB as a systematic process, habitual behavior was also the main predictor to expose travel behavior (Nordfjærn and Rundmo, 2015).

This study underpinning theory of TPB is hinged on as an applicable framework to methodically illuminate the different dimensions of travel behavior and attitude influencing by behavior beliefs (Thamizh Arasan and Vedagiri, 2011; Thøgersen, 2006). Yet, some specific aspects of attitude, such as a traveler's experience and reflection at various scales, have been less explored. Additionally, the intense

knowledge and experience that people had gathered among public transport users is a reflection of people's perceptions and specific modes. However, the productive relationship between traveler's perception and attitude could be a remarkable indicator in exploring whether travel behavior in other areas of everyday life can help us better understand the influencing forces behind mode choice. Understanding the attitude, subjective norms, and perceived behavioral control (PBC) is essential, as it provides an understanding of what is to be structured and arranged within the context of particular travelers.

The increasing importance of the COM-B model is linked to recent changes in conceptualization of an integrated behavioral framework. However, COM-B model in this context is synonymously gaining popularity in social science, behavioral studies, and a link of other study fields, specifically about identifying the human behavioral indicator factors. That is why policy makers are trying to link through the problem statement, as a benefit of the COM-B model is that the model is exogenous, rational and connected to an inclusive model of individual behavior (Michie et al., 2011). However, COM-B model moves by incorporating individual capability, opportunity and motivation (Michie and Johnston, 2012).

The COM-B model outlines three key factors influencing individual's public transport use: capability, opportunity, and motivation. Capability factors, related to individual's experience, consider characteristics, demographics, and economic status (Sen, 1993). Opportunity focuses on external elements that make using public transport accessible, such as land use, service availability, and pedestrian-friendly environments (Michie et al., 2011). Finally, motivation encompasses factors like attitudes, social pressure (subjective norms), perceived ease or difficulty of use (perceived behavioral control), and intentions to use public transport (Michie et al., 2011). Previous research often focused on only one or two of these aspects. While some studies like those by Frank et al. (2008), and Titheridge and Hall (2006) explored how demographics (linking to opportunity and capability) influence mode choice, others like Chen and Chao (2011) examined the connection between attitudes, perceived control, and subjective norms on intentions and travel choices.

Meanwhile, this study underpins the theory that mode choice is supported by a variety of these interlinked factors, which influence mode choice in response to adaptations of the COM-B factors in reducing the gap between actual and previous activity participation factors, as shown in **Figure 1**. Hence, this study attempts to answer the question that, can a conceptual framework linking capability, opportunity, and motivation make an important contribution to traveler mode choice?

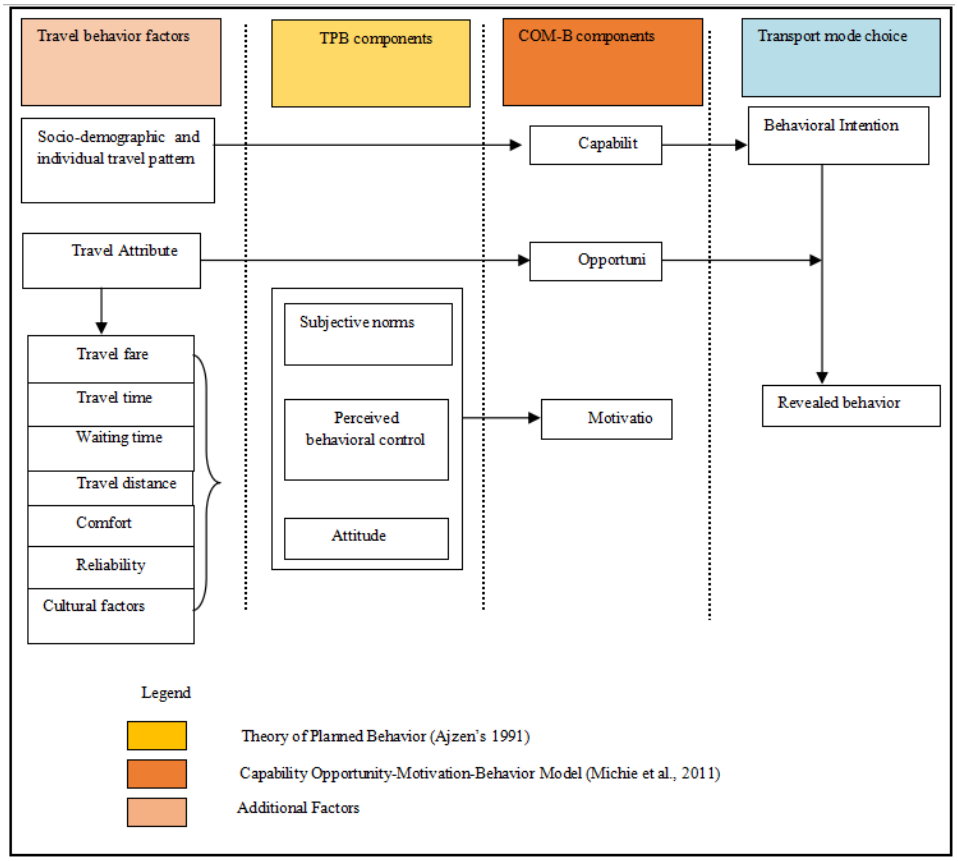

Figure 1. Theoretical foundation on public transport mode choice behavior.

3. Study approach

This study aims to develop an integrated conceptual framework for understanding travel mode choice behavior using the COM-B model. The core concepts of capability, opportunity, and motivation will be extracted from the travel behavior and mode choice literature. These concepts are not always clearly defined, and their application can vary depending on the research context (Axhausen, 2006). Researchers often incorporate these concepts with their own interpretations, leading to potential inconsistencies. However, these differing interpretations can be complementary, offering a robust understanding of main conceptual theme (Snyder, 2019). This review aims to comprehensively explore relevant research traditions that inform the studied topic. Unlike traditional approaches that rely on effect sizes, it synthesizes these traditions using overarching narratives (meta-narratives) to provide a deeper understanding of complex issues (Wong et al., 2013). While encompassing broad areas and diverse study types, this approach emphasizes research transparency. A well-developed research strategy allows readers to assess the justification of the judgments made (referring to RQ1), ensuring their reasonableness for both the chosen topic and the methodologies employed (Snyder, 2019). Due to the variability in how these concepts have been applied, a comprehensive literature review is necessary. This review will focus on foundational concepts (Wong et al., 2013), rather than solely on their application within mode choice studies. The specific sources for these concepts can vary.

This study will employ a particular approach to analyze the identified concepts

and their interactions in the context of travel mode choice. A comprehensive literature review will be conducted to identify the key elements and their interrelationships within each concept. This process will involve striking a balance between drawing detailed insights from specific studies and capturing the fundamental aspects of each concept. These key elements will then be systematically categorized under the three core dimensions of the COM-B (Capability, Opportunity, and Motivation). This categorization will serve as the foundation for developing an initial, integrative conceptual framework. This framework will visually represent the connections between these dimensions within the context of travel mode choice.

4. A conceptual approach to understanding behavioral factors in public transport

Underpinning theories have provided a clear understanding of the close relationship between behavior and intention. In this section, we aim to conceptualize previous studies focusing on travel attribute factors that fall under the COM-B framework, which includes capability, opportunity, and motivation. These factors have been identified as influential in shaping public transport mode choice behavior.

4.1. Capability: Socio-demographic characteristics

The study of social exclusion, which examines limitations on an individual's ability to participate in activities due to transportation constraints, is gaining prominence. Research suggests that socio-demographic factors like low income, lack of vehicle ownership, inadequate housing, unemployment, and age can restrict a person's transportation capabilities and contribute to social exclusion (Titheridge et al., 2014). Consequently, this study utilizes socio-demographic characteristics as indicators of capability. Numerous studies have demonstrated the profound impact of socio-demographics on travel behavior (Limtanakool et al., 2006). Likewise, age, gender, economic status or financial condition, level of education, household size, and private car ownership are major factors in influencing travel behavior (Rasouli and Timmermans, 2014; Soehodho and Rahadiani, 2012). Notably, age has been indicated as a significant correlated factor of alternative transport mode selection. Concerning income, individuals with high incomes appeared to be at a higher trend to drive than those with lower incomes, even once every group keeps inside the common areas with unique access to the structure. A convenient justification for this result is that the high-income people can use private vehicles (Vega-Gonzalo et al., 2024). The attitudinal habit of private vehicle use can be explored to a great extent by the youngsters, and is higher among male than female (Jakobsson et al., 2011). Socio-demographic factors corresponding to income, education, car accessibility, age, gender, and education are also used in several mode choice models. Among various types of travelers associated variables, income has been utilized the most in the models (Zhou, 2012). For example, higher-income travelers are usually presumed to decide on an alternative mode that gives a quick and reliable service even though it is costly. Likewise, Berrill et al. (2024) and Limtanakool et al. (2006) studied the effects of age, gender, education, household size, income, and car accessibility on mode choices decision. Besides that, vehicle ownership, safety, and comfort have also become important factors

influencing travel mode choice (Minal and Ravi Sekhar, 2014).

Klein (2017) explored how land use patterns and socio-demographic factors interact to influence travel behavior. Their investigations considered elements like income, vehicle ownership, household size, age, gender, education level, personality traits, employment status, driver's license possession, and individual attitudes. Additionally, previous research has revealed that socio-demographic, attitudinal, and cultural variables influence individuals to make a choice between different travel decisions (d'Ovidio et al., 2014; Sharaby and Shiftan, 2012).

Similar to other studies, Antipova and Wilmot (2012) demonstrated the significant influence of both socio-demographic characteristics and neighborhood design on commuting patterns. Additionally, research by Bottai et al. (2006) revealed that factors like age and gender played a role in shaping travel behaviors, specifically daily trip frequency and distances traveled. Besides that, it was also inferred that location is an important factor that affects the time, cost, and accessibility of various transport modes (Ashik et al., 2024; van Soest et al., 2020). Ashik et al. (2024) investigated different aspects of location or ownership of vehicle influence mode choice. Their study found that not only location or ownership, but the person's relevant affective factors concerning mode choice were also of importance.

4.2. Opportunity: Transport provision

Opportunity is the external aspect that influences a person's choice of travel mode. The extrinsic factors may include the service of public transportation: (i) transport service availability, (ii) accessibility of transport, and (iii) land use. The following section will examine previous research exploring the ways these factors shape public transport utilization.

4.2.1. Transport service availability and quality

Numerous investigations identified with mode choice decision have considered three significant factors as explanatory variables which are, travel time, travel cost, and service frequency (Mugion et al., 2018). Although previous research has investigated the links between service availability, quality, and mode selection, furthermore, operational performance was evaluated, including effectiveness and efficiency (Friman et al., 2020). As a result, passengers' perceptions of service quality based on demand side features are discrete from authorities' perceptions of operational performance, which is concerned with the supply side and is more focused on expanding bus service and ridership. Several studies have been conducted to assess the quality of bus service from the perspective of users. Interestingly, the analysis revealed that the most highly-valued service quality attributes for public transport users are frequency, reliability, travel time, comfort, cleanliness, bus stop amenities, and seat availability (Borhan et al., 2019; dell'Olio et al., 2011; Eboli and Mazzulla, 2009).

On the other hand, waiting time concerning the uncertainty of a specific transit vehicle also affects the passenger choice decision (Shelat et al., 2021). This is applicable to waiting time that has been determined, because "people do not mind waiting for specific mode if they know how long it is going to be". In other words, if the passenger wastes time, at least they know the fixed time (Boyle et al., 2012).

Studies have found that the waiting time concerning the uncertainty of a specific transit vehicle also affects the passenger choice decision (Shelat et al., 2021). Reducing waiting time and scope to improve passenger satisfaction and increase vehicle ridership is an example of this measure that can be used positively. As a result, the necessity for rethinking the value of information may have a significant influence on waiting time to improve route and mode choice behavior. While other analyses reported socio-demographic profiles, trip characteristics, and transport mode influenced by the travel distance (Convery and Williams, 2019). While related, comfort is one of the major concerning issues in travel attributes that can be used to assess the quality of public transport services (dell'Olio et al., 2011; Eboli et al., 2016; Eboli and Mazzulla, 2009). Eventually, this leads to increasing the passengers' expectation leading to high-quality service in the most extreme conditions (e.g., in adverse weather, sufficient seats, ample space, and accessibility and reliability information during the journey, smooth travelling or no vibration (Eboli and Mazzulla, 2009). However, also related to quality services are attributes like the vehicle performance and running conditions, reduction of the uncertainty of vehicle arrival and departure, or reliable information, which help reduce the dissatisfaction level of individual travelers' choices (Sekulić et al., 2013).

Besides, some adaptive factors integrated with an accessible riding environment and in-vehicle travel time being less than the actual travel time can ensure a reliable and comfortable journey. In this sense, comfort level can be changed due to change in passengers' perceptions of perceived journey time and reasonable riding environment evaluations (Litman, 2008). Similarly, reliability attribute may affect upon information-seeking travel behaviors, passengers may be more likely to concern out alternative modes and schedules, which focuses of accuracy and the context of public transportation services reflected by the different characteristics, depending on how passengers perceive the reliability attribute. The reliability in public transport is linked between origin to the destination while passengers are moving from one place to another place and this activity is set out by passengers to complete the journey most reliably (Fu and Xin, 2007; Yeboah et al., 2019). In fact, passengers expect the most reliable and best service route concerning fare and service. However, individual mode choice preference for the speed of service is not necessarily paid directly (Antoniou et al., 2007) and this perspective has conceptually defined two possible reasons, even if being late to work is likely to have negative repercussions, commuters essentially place a high value on the predictability that comes with a reliable transportation network (Bhat and Sardesai, 2006). Besides these, many studies have been created towards studying travelers' perception of mode choice (Nyarirangwe and Mbara, 2007). Spears et al. (2013) supported a broader view in explaining the influenced mode choice behavior integrated by the conceptualized the perception-intention-adaptation (PIA) framework to relate socio-demographic, built environment, transit service, and socio-psychological factors. This implies that perception based statements will provide some service attributes to estimate the quality of services on passenger perception (dell'Olio et al., 2011).

4.2.2. Accessibility of transport

The accessibility of public transportation is the extent to which persons may

access geographically distributed activities using public transportation. According to Murray and Stimson (1998), public transportation accessibility into three categories: access to and from sources and destinations; access by public transportation or network; and accessibility by public transportation mode. To use public transportation, one must have "access," which is defined as "the opportunity and cost for system use depending on proximity to the service" (Murray and Stimson, 1998). Access mode refers to the way of access to public transport stops chosen by passengers. Therefore, the price and availability of public transportation are just as important as the distances between service points and the origins and destinations. Passengers are flexible about trip time and exit location because of the importance of travel distance to their decision. Due to its high intention of travel-time savings, faster modes of public transportation plan to attract passengers from long distances (Pineda and Lira, 2019).

Even with other modes of access available, walking remains fundamental for reaching public transportation. As a universal form of mobility, walking benefits all individual's regardless of socioeconomic background. This is particularly true for those who might not have access to alternative transportation options, such as people with disabilities, older adults, children, and people with limited income (WALK21, 2006). One crucial measure of accessibility to public transportation is the walking distance from residences or destinations to various transit stops and stations (including bus, metro, tram, and railway) (Transport for London, 2010).

4.2.3. Land-use

Land-use factors have a significant influence on travel behavior. Land use diversity along with design features and density of development of the built environment the 3Ds have been found to influence trip frequencies, travel distances, and mode choice. Density measures a means of investigating urban form or land use (Hanni and Rao, 2024). This perspective accumulates the relationship between density and gasoline use, which was a substitution of urban form portrayed by population density and job density (Newman and Kenworthy, 2007). Land-use mix describes the integration of different types of land uses within a specific area. This might include offices, shops, restaurants, banks, and various other activities (Iannillo and Fasolino, 2021). It seeks to explore the crucial situations for developing prospective dimensions relating multi-function land use, short blocks, and configuration constructions (Rowley, 2010). Research by van Acker and Witlox (2011) demonstrated a positive correlation between diverse land use and public transport utilization for commuting and general trips. Further analysis using a binomial logit model indicated that residential density may have a greater influence on transport choices than the specific mix of land uses (Hanni and Rao, 2024).

The availability and quality of transportation infrastructure significantly influence mode choice. Adequate pedestrian and cycling infrastructure, such as dedicated lanes and safe crossings, encourage walking and cycling trips (Shbeeb, 2023). Conversely, a lack of such infrastructure can be a limiting, particularly for safety concerns (Cheng and Chen, 2015). Similarly, the availability and accessibility of public transportation systems, including stations, stops, and reliable connections, play a crucial role in attracting users (Saif et al., 2019). Studies suggest that a well-developed public transportation network can lead to a shift away from private vehicle

use (Mugion et al., 2018).

Government policies play a significant role in shaping mode choice behavior. Policies such as fuel taxes, parking regulations, tolls, and subsidies for public transportation can influence the relative cost of different travel modes (Qin et al., 2014; Yang and Wang, 2018). Additionally, investments in infrastructure development and land-use planning strategies that promote compact, mixed-use development can encourage walking, cycling, and public transportation use (Bibri et al., 2020; Duan et al., 2023).

4.3. Motivation factors for public transport use

TPB factors are categorized under motivational factors of travel mode choice as follows.

4.3.1. Attitude

The attitude factor as a rational feature has a significant effect on intentions, which consists of perceived outcomes or attributes of the behaviour (Ajzen, 2005; Liu et al., 2015; Loo et al., 2015). Following that, the expectancy by Kuppam et al. (1991) also found that the attitudinal factors were more imperative than demo-graphic variables in revealing mode choice decisions. Similarly, attitude towards transit service reliability and hassle-free influenced the mode choice decision (Popuri et al., 2011). In the attitude context, identified transparent and clear service quality indicators in the selection of mode choice can be influenced by the passenger's intention to choose modes (Mahmoud and Hine, 2013).

On the other hand, psychological factors that lead to a strengthening of attitudes but are not reflected to policymakers can also contribute towards community preferences. This argument is underpinned by the fact that studies that explore psychological factors are very limited (Fujii and Taniguchi, 2006); such as, travel smart (James, 2002), In particular, through communication and influence to give travel data and incentives, or to utilize business strategies exploring specific travel behavior of individual's, such analyses have effectively replicated in attitude and decreased the car dependency and improved the tendency to use public transport (Fujii and Taniguchi, 2006). A reasonable reason for this attitude is that individuals will adopt a preference if they have perceived that it would help them to distinguish private cars versus public transport. Such psychological investigation might be useful for measuring the transportation demand. Additionally, behavioral intention measure is a significant psychological variable that identifies the actual choice, where attitude severely affects behavioral intention, as shown in Ajzen's theory of planned behavior (Ajzen, 1991).

Besides, from previous studies, attitudes towards travel modes and the presence of psychological factors were considered good indicators of the commuter travel mode (Osman Idris et al., 2015). It is therefore important for developing countries to explore and evaluate the role of attitudes toward travel modes on the behavioral intention of choosing a commuting mode before boarding on any psychological approaches to multimodal transportation.

4.3.2. Subjective norms

Subjective norm is a feature of normative intention, which establishes perceptions

of particular significance to others' choices, about whether one should or should not engage in the behavior. Loo et al. (2015) highlighted the users' perceptions of mode and travel behavior influencing drivers' mode choice decisions. It follows that non-instrumental motivations may act as an important role for trips for relaxation or family needs which are probable to be less efficient (Garcia et al., 2009). Accordingly, Loo et al. (2015) found a positive relationship between attitudinal and socio-economic factors and considerably interrelated this to the three psychological motivations of public transport use.

4.3.3. Perceived behavioral control

Spears et al. (2013) studied the effects of attitude and perception on travel behavior by developing a PIA (Perception-Intention-Adaptation) framework. Accordingly, Hu et al. (2015) found that passengers' behavioral intentions were evaluated from the performance of services and the character of these perceptions was realized in travel decisions. Furthermore, it was shown that the reliability and comfort of bus services were the most influential factors on passenger perception, as compared to the availability and safety of the mode. Consequently, a number of studies have employed perception-based methods to assess service quality. The transportation research board's manual included specific procedures for measuring transit service based on customer perceptions (Hu et al., 2015). Iseki and Smart (2013) proposed an evaluation of transportation facility perceptions using importance-satisfaction metrics. Diana (2012) evaluated multimodal travelers' perceptions of transit services using satisfaction measures and analyzed the attitudinal data using a one-score method.

Investigated by Wan and Lo (2005), the traveler mode choice behavior using perception base attribute value was found to affect the choice behavior of transit passengers. Therefore, the degree of transit passengers' perceptions were composed to determine which service performance had influenced the travel decision (Hu et al., 2015; Thamizh and Vedagiri, 2011) indicate that perceptions of mode choice attributes are important in identifying the possibility of mode change from private to public transport. Accordingly, Wen et al. (2012) also highlight that bus transit passengers are eager to pay extra fare charges for better services, which include comfort in the bus (e.g., cleanliness and air conditioning) and decent driver attitude. Further work is, therefore, mainly concentrated on specific aspects of individual choice decisions among public transport users (e.g., choice of residential location, vehicle category and activity participation) to mode variables. Ory and Mokhtarian (2005), who found correlations between perceived behavioral control factors which connected to descriptive factors, and transportation mode selection.

5. Proposed integrative conceptual framework

Several relevant factors of mode choices are discussed in the literature review. Major portions among the literature are used to describe common traveler characteristics or attributes, which suggests their effect on mode choices. It is observed that a larger portion of the individual's choice to travel by public transportation; and the research question exposed how attribute perception factors have an influence on mode choice of public transport users, where the choice model influenced the decision. Similarly, responses to motivational factors were used as explanatory variables for

estimating the different statements whose aim is to provide particularly differentiated motivational influence to mode choices.

A number of researchers have emphasized the necessity of a more robust approach to travel behavior, as well as research that incorporates both methods and bridges this knowledge gap (Van Acker et al., 2013) while adapting a framework developed by Michie et al. (2011) that is tailored to directly investigate the psychological perceptions and attitudes associated specifically with travel behavior. Additionally, these types of investigations are mostly suggestions, but cannot be significantly encompassed to the instance of perception based relationship, in light of fact that there is no proposed methodology for investigating gaps in attribute perception, travel behavior and mode choice. Several investigations have been highlighted in the review of the literature section, in connection with exploring broadly individual perceptions by linking numerous transport service facilities (Stradling et al., 2007). However, based on the literature review mentioned above, a total of twenty six variables as mentioned in the literature are considered to be aligned with capability, opportunity, and motivation, and treated as relevant variables to be used in the conceptual relationship model development as shown in **Figure 2**. It is defined as a norm of the individual attribute perception factors, with its specific focus on choice of public transport mode. This study also adopts that attitudes, subjective norms, and PBC are interact in some way in this investigation. **Figure 2** shows the proposed conceptual framework for travel mode choice with regard to the use of public transportation integrated with the capacity, opportunity, and motivation factors.

Although the conceptual frameworks share common travel attributes of mode choice behavior and the need for integration, they differ in their emphasis on various aspects and mode choices of travelers. Consequently, none of the notions alone provides a comprehensive understanding. While conceptualizing capability, opportunity, and motivation establish proper perception factors for destination travel attributes, it overlooks what is being managed and ignores the mode choice study, particularly in the Southeast Asian context. The conceptual framework for public transportation mode choice behavior provides structured knowledge of the numerous factors and their influences that impact individual's decisions when selecting a specific mode of public transportation. As a result, such a framework can have several integrating effects on travelers and decision makers.

(i) Integrating the capability factor of socio-demographics to the conceptual framework of mode choice behavior helps us understand user characteristics, allows for targeted interventions, promotes equity and accessibility, informs policy and planning decisions, and makes it easier to measure the effectiveness of interventions. By figuring out what makes a big difference in how people choose their mode of transportation, policymakers can create interventions that target specific groups, like making transportation more accessible, making it safer, or encouraging people to use public transportation.

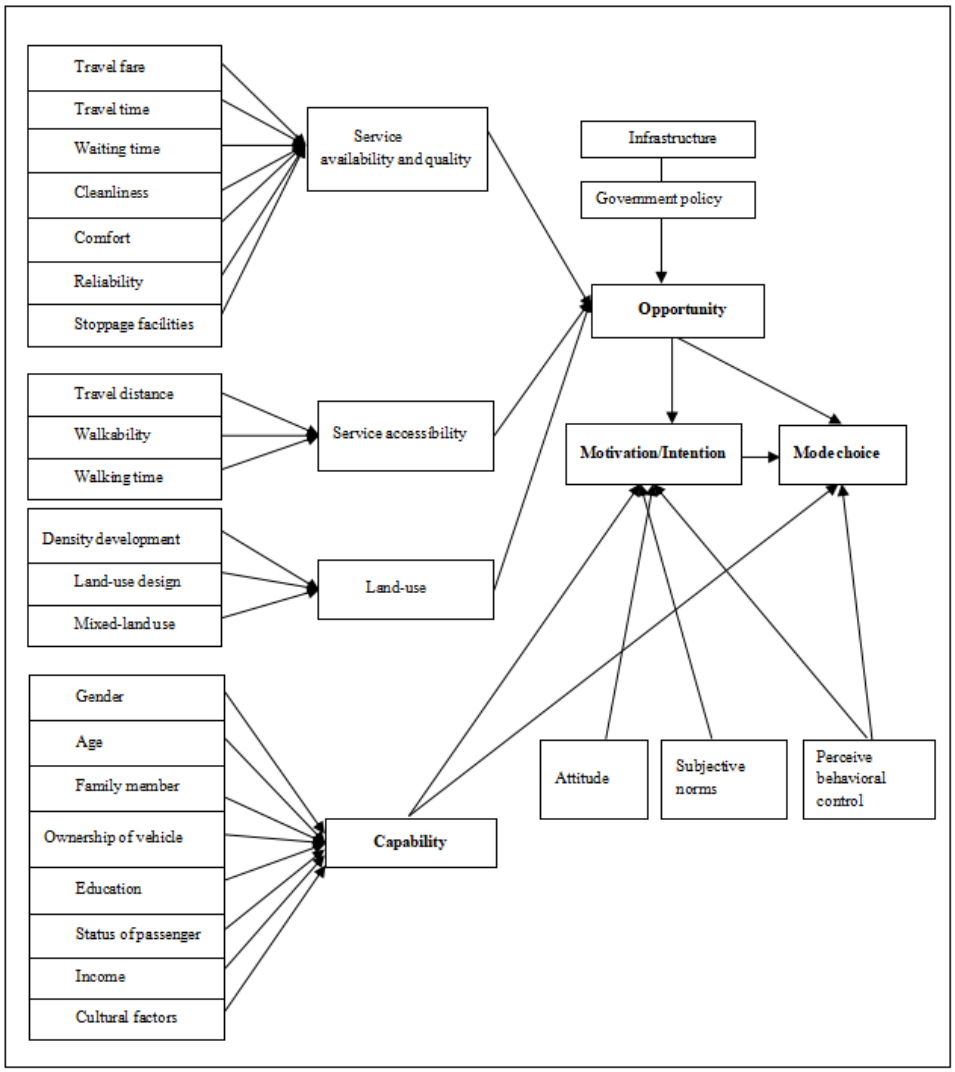

Figure 2. Conceptual framework for the role of COM-B factors for travel behavior towards public transport use.

(ii) Creating the opportunity factor of land-use in the conceptual framework for mode choice behavior gives a more complete picture of how land use patterns, multi-modal integration, land use zoning, transit-oriented development (TOD), and urban form affect mode choices. With this information, policymakers, and urban planners who invest in transportation facilities can make decisions that will lead to more sustainable and efficient mode choices.

(iii) Adding the opportunity factor of service accessibility to the conceptual framework helps transportation planner to fully understand how service availability and distribution affect mode preferences. This knowledge helps shape strategies for promoting modal shift, making opportunities for everyone to have equal access, and guiding policy and infrastructure choices to make transportation systems that are sustainable and efficient.

(iv) Adding the opportunity factor of service quality and availability to the conceptual framework provides insight into mode preferences, satisfaction levels, user experience, and perception. It guides mode shift strategies, encourages public-private partnerships, and helps build integrated transportation systems. This

knowledge helps improve the quality and quantity of services, which in the end leads to more sustainable and efficient ways to get around. This knowledge helps improve service quality and availability, eventually leading to more sustainable and efficient mode choices.

(v) Incorporating the motivational factor of attitude, subjective norms, and perceived behavioral control into the conceptual framework for mode choice behavior allows for the comprehension of individual beliefs, social influences, and perceptions of control. This understanding facilitates the design of targeted interventions, the exploitation of social norms, and the enhancement of an individual's perception of control in order to promote sustainable and efficient mode selection.

By underpinning the theories to create a comprehensive framework that can provide a complete picture of the different travel attribute factors influencing and possible ways to deal with the proposed framework, it is important to realize that attribute perception factors can not address the same perception due to cultural differences from Western to Eastern countries. Additionally, the exact perception may vary from one place to another. However, with this broader framework in place, it will be easier to make choices about priorities, how travel attributes should be used, and how to manage choice modes.

6. Findings and policy implication

This study's conceptual framework, based on the COM-B model, highlights the critical role of capability, opportunity, and motivation factors influencing public transport mode choice in Southeast Asia.

Capability factors in socio-demographic and cultural considerations play a significant role. Women, for instance, may be more likely to use public transport due to safety concerns with private vehicles, particularly at night or in crowded areas (Noor and Iamtrakul, 2023). Policies promoting well-lit stations, security personnel, and designated waiting areas for women and children can enhance female ridership and address cultural norms around safety in public spaces. Similarly, age can influence choice, with younger and older adults relying more on public transport compared to working-age adults with higher car ownership rates (Molin et al., 2016). Concessionary fares for students and seniors, coupled with public transport education programs, can encourage use among these demographics. The presence of young children or dependents may also influence travel mode, as some prioritize the convenience of a car for family trips (Djurhuus et al., 2014). Policies promoting child-friendly public transport amenities (e.g., designated stroller areas, family restrooms) and family travel discounts can incentivize public transport use for families, catering to their specific needs.

These findings emphasize the need for a nuanced approach that addresses the diverse socio-demographic and cultural contexts influencing public transport use in Southeast Asia. Implementing targeted policies that consider gender safety concerns, cater to the needs of families with young children, and offer incentives for specific age groups can create a more inclusive and user-centric public transport system.

Unreliable schedules, infrequent service, limited coverage, and concerns about

safety and security can significantly discourage public transport use (Borhan et al., 2019). Policies promoting reliable service, improved amenities within the system, enhanced security measures, and network expansion can increase ridership and make public transport a more attractive option. Additionally, investing in first- and last-mile connectivity (e.g., feeder buses, cycling infrastructure) can significantly improve accessibility, particularly for residents in outlying areas. Government Policy and Infrastructure: Fuel subsidies and limited parking regulations in some Southeast Asian countries can incentivize private vehicle use. Implementing targeted policies, such as congestion charges and promoting integrated ticketing systems, can shift the opportunity landscape towards public transport use (Shelat et al., 2021). Furthermore, investments in dedicated bus lanes, pedestrian walkways, and cycling infrastructure can create a more integrated and user-friendly transportation network, promoting a modal shift.

By focusing on these opportunity factors, policymakers in Southeast Asia can develop strategies that improve service quality, expand service networks and accessibility, and implement strategic government policies to incentivize public transport use. This comprehensive approach can lead to a more efficient, user-friendly, and attractive public transport system, encouraging sustainable transportation choices in Southeast Asia.

Perceptions of public transport convenience, comfort, and environmental benefits can significantly influence ridership. Public awareness campaigns highlighting these advantages, alongside efforts to improve service quality and amenities, can promote more positive attitudes towards public transport (Brooks et al., 2012). Subjective norms: Social pressure from family, friends, and colleagues can play a role in travel behavior. Engaging with community leaders and influencers to promote the social benefits of public transport use can create a more supportive environment for ridership. Additionally, information campaigns showcasing the growing number of public transport users can address potential feelings of isolation associated with using public transport (Loo et al., 2015). Perceived behavioral control: People are more likely to use public transport if they believe it is a convenient and readily available option. Investing in network expansion, improving service frequency and reliability, and providing real-time information on schedules and disruptions can enhance users' sense of control over their public transport journeys (Hu et al., 2015).

By addressing these motivation factors, policymakers in Southeast Asia can create a more positive and encouraging environment for public transport use. This includes promoting positive attitudes through awareness campaigns, fostering social acceptance through community engagement, and enhancing perceived behavioral control by improving service reliability, accessibility, and information provision. A multi-pronged approach targeting these factors can increase public transport ridership and contribute to a more sustainable transportation system in Southeast Asia.

7. Conclusion

This study developed a theoretical and conceptual framework from the literature review, whereby variables have been justified and summarized accordingly. The overall methodical approach and objectives of this conceptual framework were

structured into three sections, namely, opportunity factors related to transportation can be described by specific service attributes such as travel fare, travel time, waiting time, cleanliness, comfort, reliability, and accessibility factors such as travel distance, walkability, and walking time (between home to bus stop), and land-use factors such as density development, land-use design, and mixed land-use. Capability factors are described as socio-demographic characteristics such as gender, age, family member, vehicle ownership, education status, status of passenger, income level and cultural attributes. Motivation factors can be described as attitudes, subjective norms, and perceived behavioral control. Particularly, the study describes the conceptual framework and its variables that have been proposed for this study, where transport provision factors have extended from the perception of the typical attributes to the new form. This study attempts to acknowledge the usually overlooked attribute perception factors of decision-makers, comparatively due to its hidden nature to transport analysts and the potential problems of lower quality demand analysis thereof. This study underpinning the COM-B and TPB modeling framework. This consideration is important because it demonstrates how travelers make their choices with different attribute perception factors. These findings highlight the need for strategic planning, targeted interventions, and informed policy development to address the identified limitations and guide future research efforts. The main contribution of this study is that the proposed framework expects to link three variables of COM-B to predict the behavioral motivation for choosing public transport mode. This study investigates whether motivation variables can predict unobserved underlying factors influencing behavior, such as attitudes, perceived behavioral control, and subjective norms. Because uncovered latent factors are difficult to predict the relationship between these constructs and observable capacity and opportunity variables may assist in anticipating such variables. Therefore, this study develops a framework to reflect a recovery from travel attribute factors which will be of significant value in research on predicting the mode choice in Southeast Asian countries' public transport users.

This study's framework offers valuable insights into understanding behavioral factors influencing public transport mode choice in Southeast Asia. However, some limitations are important to consider for future research. Firstly, existing data sources may not fully capture regional and cultural nuances. User surveys and focus groups in specific Southeast Asian countries or demographics could provide robust data. Secondly, the framework primarily focuses on urban areas. Further research is needed to explore travel behavior and public transport use in peri-urban and rural areas, which present unique challenges and opportunities. Additionally, the cross-sectional analysis provides a snapshot in time. Longitudinal studies tracking travel behavior over time could offer deeper insights into how attitudes, norms, and perceptions evolve alongside changes in public transport infrastructure and policies. Finally, the focus on three motivation factors (attitude, subjective norms, and perceived behavioral control) could be expanded.

By addressing these limitations and pursuing these future research directions, we can gain a deeper understanding of complex factors such as cultural values, comparative studies, trust in public institutions, and perceptions of safety, particularly for women and vulnerable groups influencing public transport behavior in Southeast Asia. This knowledge can empower policymakers and transportation authorities to

develop more effective strategies that promote sustainable and user-friendly public transport systems in the region.

Funding: This research was funded by the Directorate of Research and Public Service Telkom University, Bandung, Indonesia, under grant number 11-24.13474.

Acknowledgments: The authors wish to acknowledge School of Technology Management and Logistics (STML), Universiti Utara Malaysia (UUM) and Telkom University, Bandung, Indonesia for cooperation and assistance in the field study.

Conflict of interest: The authors declare no conflict of interest.

References

Ajzen, I. (1991). The Theory of Planned Behavior. Organizational Behavior and Human Decision Processes, 50, 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Ajzen, I. (2005). Attitudes, personality and behavior, 2nd ed. Maidenhead, England: Open University Press.

Ajzen, I., & Fishbein, M. (2005). The Influence of Attitudes on Behavior the Influence of Attitudes on Behavior. In: The Handbook of Attitudes. Mahwah, NJ: Lawrence Erlbaum. pp. 173–221.

Antipova, A., & Wilmot, C. (2012). Alternative approaches for reducing congestion in Baton Rouge, Louisiana. Journal of Transport Geography, 24, 404–410. https://doi.org/10.1016/j.jtrangeo.2012.04.015

Antoniou, C., Matsoukis, E., & Roussi, P. (2007). A Methodology for the Estimation of Value-of-Time Using State-of-the-Art Econometric Models. Journal of Public Transportation, 10(3), 1–19. https://doi.org/10.5038/2375-0901.10.3.1

Ashik, F. R., Sreezon, A. I. Z., Rahman, M. H., et al. (2024). Built environment influences commute mode choice in a global south megacity context: Insights from explainable machine learning approach. Journal of Transport Geography, 116, 103828. https://doi.org/10.1016/j.jtrangeo.2024.103828

Axhausen, K. W. (2006). Concepts of Travel Behavior Research. Available online: https://www.researchgate.net/publication/237262766 (accessed on 6 January 2024).

Azhar, N. H., & Mohd Zahari, H. (2022). The Demographic Impact on Car Ownership in Kuala Lumpur. International Journal of Academic Research in Business and Social Sciences, 12(9), 522–537. https://doi.org/10.6007/ijarbss/v12-i9/14613

Bamberg, S., Ajzen, I., & Schmidt, P. (2010). Choice of Travel Mode in the Theory of Planned Behavior: The Roles of Past Choice of Travel Mode in the Theory of Planned Behavior: The Roles of Past Behavior, Habit, and Reasoned Action. Basic and Applied Social Psychology, 25(3), 175–187. https://doi.org/10.1207/S15324834BASP2503

Banister, D., & Hickman, R. (2013). Transport futures: Thinking the unthinkable. Transport Policy, 29, 283–293. https://doi.org/10.1016/j.tranpol.2012.07.005

Beirão, G., & Sarsfield Cabral, J. A. (2007). Understanding attitudes towards public transport and private car: A qualitative study. Transport Policy, 14(6), 478–489. https://doi.org/10.1016/j.tranpol.2007.04.009

Berrill, P., Nachtigall, F., Javaid, A., et al. (2024). Comparing urban form influences on travel distance, car ownership, and mode choice. Transportation Research Part D: Transport and Environment, 128, 104087. https://doi.org/10.1016/j.trd.2024.104087

Bhat, C. R., & Sardesai, R. (2006). The impact of stop-making and travel time reliability on commute mode choice. Transportation Research Part B: Methodological, 40(9), 709–730. https://doi.org/10.1016/j.trb.2005.09.008

Bibri, S. E., Krogstie, J., & Kärrholm, M. (2020). Compact city planning and development: Emerging practices and strategies for achieving the goals of sustainability. Developments in the Built Environment, 4, 100021. https://doi.org/10.1016/j.dibe.2020.100021

Borhan, M. N., Hakimi Ibrahim, A. N., Syamsunur, D., et al. (2019). Why public bus is a less attractive mode of transport: A case study of Putrajaya, Malaysia. Periodica Polytechnica Transportation Engineering, 47(1), 82–90. https://doi.org/10.3311/PPtr.9228

Brooks, M. R., Puckett, S. M., Hensher, D. A., et al. (2012). Understanding mode choice decisions: A study of Australian freight shippers. Maritime Economics and Logistics, 14(3), 274–299. https://doi.org/10.1057/mel.2012.8

Bottai, M., Salvati, N., & Orsini, N. (2006). Multilevel models for analyzing people's daily moving behavior. Journal of Geographical Systems, 8, 97–108. https://doi.org/10.1007/s10109-006-0017-x

Boyle, I. A., Duffy, A. H. B., Whitfield, R. I., et al. (2012). The impact of resources on decision making. Artificial Intelligence for Engineering Design, Analysis and Manufacturing: AIEDAM, 26(4), 407–423. https://doi.org/10.1017/S0890060412000273

Chen, C., & Chao, W. (2011). Habitual or reasoned? Using the theory of planned behavior, technology acceptance model, and habit to examine switching intentions toward public transit. Transportation Research Part F: Psychology and Behavior, 14(2), 128–137. https://doi.org/10.1016/j.trf.2010.11.006

Chen, C., & Lai, W. (2011). The effects of rational and habitual factors on mode choice behaviors in a motorcycle-dependent region: Evidence from Taiwan. Transport Policy, 18(5), 711–718. https://doi.org/10.1016/j.tranpol.2011.01.006

Cheng, Y. H., & Chen, S. Y. (2015). Perceived accessibility, mobility, and connectivity of public transportation systems. Transportation Research Part A: Policy and Practice, 77, 386–403. https://doi.org/10.1016/j.tra.2015.05.003

Convery, S., & Williams, B. (2019). Determinants of Transport Mode Choice for Non-Commuting Trips: The Roles of Transport, Land Use and Socio-Demographic Characteristics. Urban Science, 3(3), 1–25. https://doi.org/10.3390/urbansci3030082

d'Ovidio, F. D., Leogrande, D., Mancarella, R., et al. (2014). A Multivariate Analysis of the Quality of Public Transport Services. Procedia Economics and Finance, 17(14), 238–247. https://doi.org/10.1016/S2212-5671(14)00868-5

dell'Olio, L., Ibeas, A., & Cecin, P. (2011). The quality of service desired by public transport users. Transport Policy, 18(1), 217–227. https://doi.org/10.1016/j.tranpol.2010.08.005

Diab, E. I., & El-Geneidy, A. M. (2012). Understanding the impacts of a combination of service improvement strategies on bus running time and passenger's perception. Transportation Research Part A: Policy and Practice, 46(3), 614–625. https://doi.org/10.1016/j.tra.2011.11.013

Diana, M. (2012). Measuring the satisfaction of multimodal travelers for local transit services in different urban contexts. Transportation Research Part A, 46(1), 1–11. https://doi.org/10.1016/j.tra.2011.09.018

Djurhuus, S., Hansen, H. S., Aadahl, M., et al. (2014). The association between access to public transportation and self-reported active commuting. International Journal of Environmental Research and Public Health, 11(12), 12632–12651. https://doi.org/10.3390/ijerph111212632

Dios, J. D, González, R. M., Journal, S., et al. (2015). Inter-Island Travel Demand Response with Discrete Choice Models. Journal of Transport Economics and Policy, 36(1), 115–138.

Domarchi, C., & Tudela, A. (2008). Effect of attitudes, habit and affective appraisal on mode choice: an application to university workers. Transportation, 35, 585–599. https://doi.org/10.1007/s11116-008-9168-6

Donald, I. J., Cooper, S. R., & Conchie, S. M. (2014). An extended theory of planned behavior model of the psychological factors affecting commuters' transport mode use. Journal of Environmental Psychology, 40, 39–48. https://doi.org/10.1016/j.jenvp.2014.03.003

Duan, Y., Yuan, C., Mao, X., et al. (2023). Influence of the built environment on taxi travel demand based on the optimal spatial analysis unit. PLoS ONE, 18(10), 1–27. https://doi.org/10.1371/journal.pone.0292363

Eboli, L., & Mazzulla, G. (2009). A New Customer Satisfaction Index for Evaluating Transit Service Quality. Journal of Public Transport, 12, 21–37. https://doi.org/10.5038/2375-0901.12.3.2

Eboli, L., Mazzulla, G., & Pungillo, G. (2016). Measuring Bus Comfort Levels by using Acceleration Instantaneous Values. Transportation Research Procedia, 18, 27–34. https://doi.org/10.1016/j.trpro.2016.12.004

Frank, L., Bradley, M., Kavage, S., et al. (2008). Urban form, travel time, and cost relationships with tour complexity and mode choice. Transportation, 37–54. https://doi.org/10.1007/s11116-007-9136-6

Friman, M., Lättman, K., & Olsson, L. E. (2020). Public Transport Quality, Safety, and Perceived Accessibility. Sustainability (Switzerland), 12, 3563. https://doi.org/10.3390/su12093563

Fu, L., & Xin, Y. (2007). A New Performance Index for Evaluating Transit Quality of Service. Journal of Public Transportation, 10(3), 47–69. https://doi.org/10.5038/2375-0901.10.3.4

Fujii, S., & Taniguchi, A. (2006). Determinants of the effectiveness of travel feedback programs—A review of communicative mobility management measures for changing travel behavior in Japan. Transport Policy, 13, 339–348. https://doi.org/10.1016/j.tranpol.2005.12.007

Garcia, D. L., Lois, D., & López-sáez, M. (2009). The relationship between instrumental, symbolic and affective factors as predictors of car use: A structural equation ... as predictors of car use: A structural equation modeling approach. Transportation Research Part A, 43(9–10), 790–799. https://doi.org/10.1016/j.tra.2009.07.008

Guo, Y., Yang, L., Huang, W., et al. (2020). Traffic safety perception, attitude, and feeder mode choice of metro commute: Evidence from Shenzhen. International Journal of Environmental Research and Public Health, 17(24), 1–20.

https://doi.org/10.3390/ijerph17249402

Hanni, C. K., & Rao, K. V. K. (2024). Factors influencing the residential location choice of individuals working at an integrated township. Transport Policy, 14, 59–69. https://doi.org/10.1016/j.tranpol.2023.12.016

Hu, X., Zhao, L., & Wang, W. (2015). Impact of perceptions of bus service performance on mode choice preference. Advances in Mechanical Engineering, 7(3), 1–11. https://doi.org/10.1177/1687814015573826

Idrisa, A. O., Habiba, K. M. N., & Shalaby, A. (2015). Investigating the effects of psychological factors. Transportation Planning and Technology, 38(3). https://doi.org/10.1080/03081060.2014.997451

Iseki, H., & Smart, M. J. (2013). How Do People Perceive Service Attributes at Transit Facilities? Examination of Perceptions of Transit Service by Transit User Demographics and Trip Characteristics. Transportation Research Record, 2274, 164–174. https://doi.org/10.3141/2274-18

Iannillo, A., & Fasolino, I. (2021). Land-use mix and urban sustainability: Benefits and indicators analysis. Sustainability (Switzerland), 13(23). https://doi.org/10.3390/su132313460

Jakobsson, C., Gamble, A., Hagman, O., et al. (2011). Affective—symbolic and instrumental—independence psychological motives mediating effects of socio-demographic variables on daily car use. Journal of Transport Geography, 19(1), 33–38. https://doi.org/10.1016/j.jtrangeo.2009.11.006

James, B. (2002). TravelSmartölarge-scale cost-effective mobility management. Experiences from Perth, Western Australia. Proceedings of the Institution of Civil Engineers, 1, 39–48. https://doi.org/10.1680/muen.2002.151.1.39

Kaewkluengklom, R., Satiennam, W., Jaensirisak, S., et al. (2017). Influence of psychological factors on mode choice behaviors: Case study of BRT in Khon Kaen City, Thailand. Transportation Research Procedia, 25, 5072–5082. https://doi.org/10.1016/j.trpro.2017.05.213

Karimi, S., Karami, H., & Samadzad, M. (2024). The role of travel satisfaction and attitudes toward travel modes in the prospect of adoption of urban air taxis: Evidence from a stated preference survey in Tehran. Transportation Research Part A: Policy and Practice, 179, 103885. https://doi.org/10.1016/j.tra.2023.103885

Klein, N. (2017). More than just a bus ride: The role of perceptions in travel behavior. Urban Studies, 54(11), 2490–2503. https://doi.org/10.1177/0042098016649324

Klöckner, C. A., & Blöbaum, A. (2010). A comprehensive action determination model: Toward a broader understanding of ecological behavior using the example of travel mode choice. Journal of Environmental Psychology, 30(4), 574–586. https://doi.org/10.1016/j.jenvp.2010.03.001

Kuppam, A. R., Pendyala, R. M., & Shela, R. (1991). Analysis of the Role of Traveler Attitudes and Perceptions in Explaining. Transportation Research Record: Journal of the Transportation Research Board, 99, 1676.

Lai, W. T., & Chen, C. F. (2011). Behavioral intentions of public transit passengers—The roles of service quality, perceived value, satisfaction and involvement. Transport Policy, 18(2), 318–325. https://doi.org/10.1016/j.tranpol.2010.09.003

Lamondia, J., Snell, T., & Bhat, C. R. (2010). Traveler behavior and values analysis in the context of vacation destination and travel mode choices: European union case study. Transportation Research Record, 2156, 140–149. https://doi.org/10.3141/2156-16

Limtanakool, N., Dijst, M., & Schwanen, T. (2006). The influence of socioeconomic characteristics, land use and travel time considerations on mode choice for medium- and longer-distance trips. Journal of Transport Geography, 14(5), 327–341. https://doi.org/10.1016/j.jtrangeo.2005.06.004

Litman, T. (2008). Valuing Transit Service Quality Improvements. Journal of Public Transportation, 11(2), 43–66. https://doi.org/10.5038/2375-0901.11.2.3

Liu, X., Yan, W. Y., & Chow, J. Y. J. (2015). Time-geographic relationships between vector fields of activity patterns and transport systems. Journal of Transport Geography, 42, 22–33. https://doi.org/10.1016/j.jtrangeo.2014.10.005

Long, B., Choocharukul, K., & Nakatsuji, T. (2011). Behavioral Intention Toward Future Sky Train Usage in Phnom Penh, Cambodia. Transportation Research Record, 63–70. https://doi.org/10.3141/2217-08

Loo, L. Y. L., Corcoran, J., Mateo-Babiano, D., et al. (2015). Transport mode choice in South East Asia: Investigating the relationship between transport users' perception and travel behavior in Johor Bahru, Malaysia. Journal of Transport Geography, 46, 99–111. https://doi.org/10.1016/j.jtrangeo.2015.06.011

Madhuwanthi, R. A. M., Marasinghe, A., Rajapakse, R. P. C. J., et al. (2016). Factors Influencing to Travel Behavior on Transport Mode Choice. International Journal of Affective Engineering, 15(2), 63–72. https://doi.org/10.5057/ijae.IJAE-D-15-00044

Mahmoud, M., & Hine, J. (2013). Using AHP to measure the perception gap between current and potential users of bus services.

Transportation Planning and Technology, 36(1), 4–23. https://doi.org/10.1080/03081060.2012.745316

Martin Fishbein, A., Lohmann, S., & Albarracín, D. (2018). The Influence of Attitudes on Behavior. In: The Handbook of Attitudes, 2nd ed. Routledge. https://doi.org/10.4324/9781410612823-13

Michie, S., & Johnston, M. (2012). Theories and techniques of behavior change: Developing a cumulative science of behavior change. Health Psychology Review, 6(1), 1–6. https://doi.org/10.1080/17437199.2012.654964

Michie, S., Stralen, M. M. V, & West, R. (2011). The behavior change wheel: A new method for characterising and designing behavior change interventions. Implementation Science, 6(42). https://doi.org/10.1186/1748-5908-6-42

Minal, & Ravi Sekhar, C. (2014). Mode Choice Analysis: The Data, the Models and Future Ahead. International Journal for Traffic and Transport Engineering, 4(3), 269–285.

Molin, E., Mokhtarian, P., & Kroesen, M. (2016). Multimodal travel groups and attitudes: A latent class cluster analysis of Dutch travelers. Transportation Research Part A: Policy and Practice, 83, 14–29. https://doi.org/10.1016/j.tra.2015.11.001

Mohammadzadeh, M. (2020). Exploring tertiary students' travel mode choices in Auckland: Insights and policy implications. Journal of Transport Geography, 87, 102788. https://doi.org/10.1016/j.jtrangeo.2020.102788

Mugion, R. G., Toni, M., Raharjo, H., et al. (2018). Does the service quality of urban public transport enhance sustainable mobility? Journal of Cleaner Production, 174, 1566–1587. https://doi.org/10.1016/j.jclepro.2017.11.052

Murray, A. T., & Stimson, R. J. (1998). Public Transport Access. Transportation Research Part D: Transport and Environment, 3(5), 319–328.

Newman, P. W. G., & Kenworthy, J. R. (2007). Gasoline Consumption and Cities. Journal of the American Planning Association, 37–41. https://doi.org/10.1080/01944368908975398

Nordfjærn, T., & Rundmo, T. (2015). Predictors of car use habit strength in an urban Norwegian public. Transportation, 42, 1–14. https://doi.org/10.1007/s11116-015-9668-0

Noor, S., & Iamtrakul, P. (2023). Women's access to urban public transport: Toward addressing policy constraints in combating sexual harassment. Transport Policy, 137(14–22). https://doi.org/https://doi.org/10.1016/j.tranpol.2023.04.010

Nyarirangwe, M., & Mbara, T. (2007). Public Transport Service Modal Choice, Affordability and Perceptions in an Unpalatable Economic Environment: The Case of an Urban Corridor in Harare (Zimbabwe). In: Proceedings of the 26th Southern African Transport Conference (SATC 2007), 9–12 July 2007. pp. 26–34.

Ory, D. T., & Mokhtarian, P. L. (2005). When is getting there half the fun? Modeling the liking for travel. Transportation Research Part A: Policy and Practice, 39(2–3), 97–123. https://doi.org/10.1016/j.tra.2004.09.006

Osman Idris, A., Habib, K. M. N., Tudela, A., et al. (2015). Investigating the effects of psychological factors on commuting mode choice behavior. Transportation Planning and Technology, 38(3), 265–276. https://doi.org/10.1080/03081060.2014.997451

Ou, Y., Zheng, J., & Nam, K. M. (2022). Impacts of Urban Rail Transit on On-Road Carbon Emissions: A Structural Equation Modeling Approach. Atmosphere, 13(11). https://doi.org/10.3390/atmos13111783

Phun, V. K., Kato, H., & Yai, T. (2018). Traffic risk perception and behavioral intentions of paratransit users in Phnom Penh. Transportation Research Part F: Traffic Psychology and Behaviour, 55, 175–187. https://doi.org/10.1016/j.trf.2018.03.008

Pineda, C., & Lira, B. M. (2019). Travel Time Savings Perception and Well-Being through Public Transport Projects: The Case of Metro de Santiago. Urban Science, 3(1). https://doi.org/10.3390/urbansci3010035

Popuri, Y., Proussaloglou, K., Cemal, A., et al. (2011). Importance of traveler attitudes in the choice of public transportation to work: findings from the Regional Transportation Authority Attitudinal Survey. Transportation, 38, 643–661. https://doi.org/10.1007/s11116-011-9336-y

Qin, P., Zheng, X., & Wang, L. (2014). Travel mode choice and impact of fuel tax in Beijing. Environment and Development Economics, 19(1), 92–110. https://doi.org/10.1017/S1355770X13000314

Rasouli, S., & Timmermans, H. (2014). Applications of theories and models of choice and decision-making under conditions of uncertainty in travel behavior research. Travel Behavior and Society, 1(3), 79–90. https://doi.org/10.1016/j.tbs.2013.12.001

Rodrıguez, D. A., & Joo, J. (2004). The relationship between non-motorized mode choice and the local physical environment. Transportation Research Part D, Transport and Environment, 9, 151–173. https://doi.org/10.1016/j.trd.2003.11.001

Rowley, A. (2010). Mixed-use Development: Ambiguous concept, simplistic analysis and wishful thinking? Mixed-use Development: ambiguous concept, simplistic analysis and wishful thinking? Planning Practice & Research, 11(1), 85–97. https://doi.org/10.1080/02697459650036477

Saif, M. A., Zefreh, M. M., & Torok, A. (2019). Public transport accessibility: A literature review. Periodica Polytechnica Transportation Engineering, 47(1), 36–43. https://doi.org/10.3311/PPtr.12072

Schwanen, T., & Mokhtarian, P. L. (2005). What affects commute mode choice: neighborhood physical structure or preferences toward neighborhoods? Journal of Transport Geography, 13(1), 83–99. https://doi.org/10.1016/j.jtrangeo.2004.11.001

Schwartz, S. H., & Howard, J. (1981). A Normative Decision-Making Model of Altruism. In: Rushton, P. J., Sorrentino, R. M. (editors). ltruism and Helping Behavior: Social, Personality, and Developmental Perspectives. Lawrence Erlbaum, Hillsdale. pp. 189–211.

Sekulić, D., Dedović, V., Rusov, S., et al. (2013). Analysis of vibration effects on the comfort of intercity bus users by oscillatory model with ten degrees of freedom. Applied Mathematical Modelling, 37(18–19), 8629–8644. https://doi.org/10.1016/j.apm.2013.03.060

Sen, A. (1993). Capability and Well-Being. In: The Quality of Life. Clarendon Press Oxford. pp. 50–53.

Sharaby, N., & Shiftan, Y. (2012). The impact of fare integration on travel behavior and transit ridership. Transport Policy, 21, 63–70. https://doi.org/10.1016/j.tranpol.2012.01.015

Shelat, S., Cats, O., & van Lint, J. W. C. (2021). Quantifying travelers' evaluation of waiting time uncertainty in public transport networks. Travel Behaviour and Society, 25, 209–222. https://doi.org/10.1016/j.tbs.2021.07.009

Shbeeb, L. (2023). How Users Perceive Infrastructure Development Affects Their Transport Mode Choice. Journal of Transportation Technologies, 13(04), 545–598. https://doi.org/10.4236/jtts.2023.134025

Soehodho, S., & Rahadiani, F. (2012). Transport Mode Choice by Land Transport Users in Jabodetabek (Jakarta-Bogor-Depok-Tangerang- Bekasi): An Urban Ecology Analysis. 177–181.

Spears, S., Houston, D., & Boarnet, M. G. (2013). Illuminating the unseen in transit use: A framework for examining the effect of attitudes and perceptions on travel behavior. Transportation Research Part A, 58, 40–53. https://doi.org/10.1016/j.tra.2013.10.011

Steg, L. (2005). Car use: Lust and must. Instrumental, symbolic and affective motives for car use. Transportation Research Part A: Policy and Practice, 39(2–3), 147–162. https://doi.org/10.1016/j.tra.2004.07.001

Stradling, S., Carreno, M., Rye, T., et al. (2007). Passenger perceptions and the ideal urban bus journey experience. Transport Policy, 14, 283–292. https://doi.org/10.1016/j.tranpol.2007.02.003

Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. Journal of Business Research, 104, 333–339. https://doi.org/10.1016/j.jbusres.2019.07.039

Thamizh Arasan, V., & Vedagiri, P. (2011). Modelling Modal Shift from Personal Vehicles to Bus on Introduction of Bus Priority Measure. Asian Transport Studies, 1(3), 288–302.

Thøgersen, J. (2006). Understanding repetitive travel mode choices in a stable context: A panel study approach. Transportation Research Part A: Policy and Practice, 40(8), 621–638. https://doi.org/10.1016/j.tra.2005.11.004

Thorhauge, M., Haustein, S., & Cherchi, E. (2016). Accounting for the Theory of Planned Behavior in departure time choice. Transportation Research Part F, 38, 94–105. https://doi.org/10.1016/j.trf.2016.01.009

Titheridge, H., Christie, N., Mackett, R., et al. (2014). Transport and Poverty A review of the evidence. Available online: https://discovery.ucl.ac.uk/id/eprint/1470392/ (accessed on 6 January 2024).

Titheridge, H., & Hall, P. (2006). Changing travel to work patterns in South East England. Journal of Transport Geography, 14(1), 60–75. https://doi.org/10.1016/j.jtrangeo.2005.06.006

Transport for London. (2010). Measuring Public Transport Accessibility Levels PTALs Summary. Available online: https://s3-eu-west-1.amazonaws.com/londondatastore-upload/PTAL-methodology.pdf (accessed on 6 January 2024).

Tsai, C. H., Mulley, C., & Clifton, G. (2012). The spatial interactions between public transport demand and land use characteristics in the Sydney greater metropolitan area. In: Proceedings of the 35th Annual Australasian Transport Research Forum ATRF 2012; 26–28 September; Perth, Australia.

Van Acker, V., Derudder, B., & Witlox, F. (2013). Why people use their cars while the built environment imposes cycling. Journal of Transport and Land Use, 6(1), 53–62. https://doi.org/10.5198/jtlu.v6i1.288

van Acker, V., & Witlox, F. (2011). Commuting trips within tours: How is commuting related to land use? Transportation, 38(3), 465–486. https://doi.org/10.1007/s11116-010-9309-6

Van Cranenburgh, S., Chorus, C. G., & van Wee, B. (2014). Vacation behavior under high travel cost conditions—A stated preference of revealed preference approach. Tourism Management, 43, 105–118. https://doi.org/10.1016/j.tourman.2014.01.022

Van, H. T., Choocharukul, K., & Fujii, S. (2014). The effect of attitudes toward cars and public transportation on behavioral intention in commuting mode choice—A comparison across six Asian countries. Transportation Research Part A: Policy and

Practice, 69, 36–44. https://doi.org/10.1016/j.tra.2014.08.008

van Soest, D., Tight, M. R., & Rogers, C. D. F. (2020). Exploring the distances people walk to access public transport. Transport Reviews, 40(2), 160–182. https://doi.org/10.1080/01441647.2019.1575491

Venter, C., Mahendra, A., & Hidalgo, D. (2019). From Mobility to Access for All: Expanding Urban Transportation Choices in the Global South. World Resource Report, 48.

Vega-Gonzalo, M., Aguilera-García, Á., Gomez, J., et al. (2024). Analysing individuals' use of moped-sharing and their perception about future private car dependency. Cities, 146, 104741. https://doi.org/10.1016/j.cities.2023.104741

WALK21. (2006). International Charter of Walking. Available online: https://walk21.com/wp-content/uploads/2020/02/walking-charter-document-2020.pdf (accessed on 6 January 2024).

Wan, Q., & Lo, H. K. (2005). Effect of attribute perceptions on mode choice behavior in a transit market. Journal of the Eastern Asia Society for Transportation Studies, 6, 1740–1750.

Wen, C., Huang, W., Fu, C., et al. (2012). Transportmetrica A latent class generalised nested logit model and its application to modelling carrier choice with market segmentation. Transportmetrica, 1–20. https://doi.org/10.1080/18128602.2011.653998

Wong, G., Greenhalgh, T., Westhorp, G., et al. (2013). RAMESES publication standards: Meta-narrative reviews. Journal of Advanced Nursing, 69(5), 987–1004. https://doi.org/10.1111/jan.12092

Yang, L., & Wang, Y. (2018). Commuting mode choice behaviour study and policy suggestions for low-carbon emission transportation in Xi'an (China). Tehnicki Vjesnik, 25(4), 1169–1173. https://doi.org/10.17559/TV-20160802061737

Yeboah, G., Cottrill, C. D., Nelson, J. D., et al. (2019). Understanding factors influencing public transport passengers' pre-travel information-seeking behavior. Public Transport, 11(1), 135–158. https://doi.org/10.1007/s12469-019-00198-w

Zhou, Y., Wang, P., Zheng, S., et al. (2024). Modeling dynamic travel mode choices using cumulative prospect theory. Transportation Research Part A: Policy and Practice, 179, 103938. https://doi.org/10.1016/j.tra.2023.103938

Zhou, J. (2012). Sustainable commute in a car-dominant city: Factors affecting alternative mode choices among university students. Transportation Research Part A, 46(7), 1013–1029. https://doi.org/10.1016/j.tra.2012.04.001

Zhu, P., Wang, K., Ho, S. N., et al. (2023). How is commute mode choice related to built environment in a high-density urban context? Cities, 134, 104180. https://doi.org/10.1016/j.cities.2022.104180