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Culture-Based Factors Influencing Public Transportation Use: An Extended Theory of Planned Behavior

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Abstract

Purpose: This study proposes a conceptual model to explain Indonesian public transportation use intention by adding culture-based variables to the TPB framework using a SOR approach.
Research Methodology: A qualitative systematic literature review with comparative analysis was conducted, reviewing twelve empirical TPB-based public transportation studies. A bibliometric meta-analysis of 275 articles using the keyword "cultural public transportation" highlighted the scarcity of culture-integrated studies.
Results: The review indicates contradictory findings in previous TPB studies, particularly for subjective norms, descriptive norms, and perceived behavioral control. None incorporated Hofstede's cultural dimensions as explanatory variables. The meta-analysis confirms that cultural aspects are rarely considered in public transportation research. Based on these gaps, a conceptual model is proposed where culture-based public transportation functions as a SOR stimulus, shaping attitudes, subjective norms, and perceived behavioral control, which in turn determine use intention.
Conclusions: Culture-based public transportation provides a theoretically coherent and empirically unaddressed extension of TPB for Indonesia's multicultural context. The model introduces a culturally sensitive demand-side stimulus to improve system design and strengthen behavioral intention formation mechanisms.
Limitations: The study is conceptual and does not empirically test the proposed model; hypotheses require validation through surveys with culturally diverse Indonesian users.
Contributions: This research contributes to transportation behavior theory and urban mobility policy by proposing the first integrated culture-TPB-SOR model, defining culture-based public transportation constructs, and generating a seven-hypothesis agenda for empirical testing.

Keywords: *Culture-Based Public Transportation, Hofstede Cultural Dimensions, Public Transportation Intention, SOR Model, Theory of Planned Behavior*

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1. Introduction

Transportation represents one of the most significant structural challenges facing rapidly urbanizing developing countries. Indonesia, with a population of 275.4 million people (Badan Pusat Statistik, 2022) and a high urban concentration in cities such as Jakarta, where the population density reaches 14,464 people per km^2 (World Bank, 2022), faces acute urban mobility challenges, including severe road congestion, deteriorating air quality (IQAir, 2019), and the environmental consequences of predominantly

private vehicle transportation. Carbon pollutants from fossil fuel transportation contribute an estimated 29% of the total environmental damage (United States Environmental Protection Agency, 2020), and Indonesia's private vehicle usage is exceptionally high, with 112 million motorbike units (40.9% of the population) and 16 million private cars (5.85%) used in daily activities (Badan Pusat Statistik, 2020).

The public health, environmental, and economic case for shifting Indonesian urban commuters to public transportation modes is compelling: public transportation reduces fossil fuel consumption and CO_2 emissions, alleviates congestion, and contributes to economic growth (Donald et al., 2014; Hasan, 2022; Hendiyana et al., 2022). The transfer of commuters to public transportation modes can contribute to repairing environmental damage by up to 10% (American Public Transportation Association, 2007). However, despite substantial government investment in public transportation infrastructure improvement, including TransJakarta BRT expansion, MRT Jakarta development, and light rail transit projects, the community response has been paradoxically muted: public adoption remains low, whereas private vehicle usage continues to grow (**lubis2021**). This creates an apparent causation paradox: improved public transportation quality and quantity should increase adoption, yet this conversion does not occur at scale.

The Theory of Planned Behavior (TPB; Ajzen, 1991) has been the dominant theoretical framework for explaining public transportation use intention, predicting that attitudes, subjective norms, and perceived behavioral control jointly determine behavioral intention and subsequent behaviors (Arimbawa & Suryawan, 2022; Barbera & Ajzen, 2020; Hamilton et al., 2020). However, the application of TPB to public transportation research has produced inconsistent empirical results across 12 reviewed studies: some find attitude to be the dominant predictor (Ambak et al., 2016), others find perceived behavioral control (Shaaban and Maher, 2019), others identify personal norms as the most influential (Bamberg et al., 2007), and some find subjective norms insignificant (Donald et al., 2014; Ibrahim et al., 2020). This empirical inconsistency suggests that the standard TPB model may be missing an important dimension of explanation.

This study identifies the missing dimension as a culture-based public transportation design. Indonesia is one of the world's most culturally diverse nations, with over 300 distinct ethnic groups, each carrying distinct cultural values, social interaction preferences, spatial orientation norms, and status consciousness patterns (Kementerian Pendidikan dan Kebudayaan, 2016). These cultural differences systematically shape transportation preferences and needs; however, no prior study in the reviewed literature has integrated Hofstede's (Hofstede, 1980) cultural dimensions framework as an explicit explanatory variable in TPB-based public transportation research. By extending TPB through the Stimulus-Organism-Response (SOR) framework (Mehrabian & Russell, 1974), this study positions culture-based public transportation as the missing stimulus variable that shapes the organism variables (attitude, subjective norm, perceived behavioral control) determining the use intention.

This review pursues four objectives: (1) to synthesize the inconsistent empirical findings of prior extended TPB public transportation studies; (2) to demonstrate the scarcity of culture-integrated public transportation research through bibliometric meta-analysis; (3) to develop the theoretical construct of culture-based public transportation using Hofstede's cultural dimensions; and (4) to propose an integrated TPB–stimulus-organism-response (TPB-SOR) conceptual model with seven testable research hypotheses for empirical validation.

2. Literature Review

2.1 Theory of Planned Behavior (TPB)

The Theory of Planned Behavior (Ajzen, 1991) is a psychological theory that explains the relationship between beliefs and behavior through three core antecedent constructs: attitude toward behavior (an

individual's positive or negative evaluation of performing the behavior), subjective norms (perceived social pressure from significant others to perform or not perform the behavior), and perceived behavioral control (the individual's perception of their ability and control over behavior). Together, these three constructs determine behavioral intention, which directly predicts actual behavior (Rozenkowska, 2023; Susanto et al., 2023). TPB was developed from the Theory of Reasoned Action (TRA; Eagly and Chaiken, 1993), which Ajzen extended by adding perceived behavioral control to address TRA's inability to predict behaviors under incomplete volitional control (Ajzen, 1991; Bosnjak et al., 2020; Rozenkowska, 2023).

In the public transportation context, the TPB has been widely applied because mode choice involves both attitudinal evaluations (does public transportation offer acceptable quality?) Social normative considerations (Do peers and family use public transportation?), and control perceptions (e.g., whether public transportation is accessible, affordable, and navigable). However, the model does not incorporate a stimulus dimension—the external environmental trigger that activates attitude, norm, and control appraisal. This structural absence is the theoretical gap addressed by the SOR framework (Hagger et al., 2022; Yuriev et al., 2020).

2.2 Stimulus-Organism-Response (SOR) Model

The SOR paradigm (Mehrabian and Russell, 1974) conceptualizes behavior as the result of a three-stage process: stimuli (external environmental factors that activate individual processing), organism (the individual's internal psychological states—attitudes, emotions, perceptions—formed in response to stimuli), and response (behavioral outcomes produced by the organism's internal state) (Hernawan et al., 2023; Kim et al., 2020; Kıymalıoğlu et al., 2024). Marketing research has extensively applied the SOR model to explain how environmental stimuli shape consumers' internal states that drive purchasing behavior. When integrated with TPB, SOR supplies the missing stimulus dimension: culture-based public transportation design constitutes the stimulus (S), while TPB's attitude, subjective norm, and perceived behavioral control constitute the organism variables (O), and use intention constitutes the response (R) (Mishra et al., 2022; Pandita et al., 2021; Zhu et al., 2020).

2.3 Hofstede's Cultural Dimensions Framework

Hofstede's (Hofstede, 1980; Hofstede and Minkov, 2010) cultural dimensions theory identifies five dimensions along which national and sub-national cultures systematically vary: power distance (extent to which less powerful members accept unequal power distribution); uncertainty avoidance (tolerance for ambiguity and unstructured situations); individualism-collectivism (degree to which individuals prioritize personal versus group interests); masculinity-femininity (relative emphasis on achievement versus quality-of-life values); and long-term versus short-term orientation (extent to which future rewards versus present stability are prioritized). These cultural dimensions systematically shape transportation preferences: individuals with high power distance may require transportation that does not compromise perceived social status; individuals with high uncertainty avoidance require predictable, structured transportation schedules; individualists require personal space and privacy; masculine individuals prioritize efficiency and competition; and long-term-oriented individuals value process-quality experiences over speed alone. Understanding these cultural orientations enables public transportation providers to design service attributes that resonate with users' cultural frameworks.

2.4 Culture-Based Public Transportation Construct

Culture-based public transportation is defined in this study as a public transportation system designed and operated with reference to the cultural dimensions of its users—specifically, Hofstede's five cultural dimensions—to align service attributes with users' culturally conditioned preferences, needs, and comfort standards (Austin et al., 2022; Lesmini & Fadhlurrahman, 2023; Syaharuddin et al., 2020). This construct serves as the SOR stimulus in the proposed integrated model: when users perceive that public

transportation has been designed with their cultural context in mind, this perception activates favorable attitude formation, subjective norm alignment, and perceived behavioral control assessments that combine to strengthen the use intention (Parmenas et al., 2023; Widiyanto et al., 2023). Culture-based public transportation represents both a design philosophy (how services should be developed) and a perceptual construct (how users evaluate whether the transportation meets their cultural needs) (Al-Mohannadi et al., 2023; Putri et al., 2021; Wu et al., 2023).

3. Methodology

This study employs a qualitative systematic literature review and comparative analysis. Twelve empirical studies on Theory of Planned Behavior applications in public transportation use intention research were identified through systematic searches of academic databases including Google Scholar, ScienceDirect, and Scopus using keywords including 'Theory of Planned Behavior,' 'public transportation intention,' 'extended TPB,' and 'transport mode choice behavior.' The inclusion criteria required that studies: (1) explicitly applied TPB or extended-TPB as the theoretical framework; (2) tested public transportation use intention as the dependent variable; and (3) were published in peer-reviewed journals. Each study was critically analyzed for its variable configuration, research context, and key findings, with particular attention to inconsistencies across studies that motivate the proposed extension (Creswell, 2020).

A bibliometric meta-analysis was conducted using 275 journal articles identified through the keyword combination 'cultural public transportation' across multiple publishers. Keyword co-occurrence mapping using VOSviewer software generated visual network clusters that reveal the frequency and interconnection of research themes—specifically demonstrating the scarcity of culture-integrated public transportation studies. This meta-analysis provides empirical evidence for the research gap addressed by the proposed model extension.

4. Results and Discussion

4.1 Results

4.1.1 Research Gap Table: Inconsistent TPB Findings in Public Transportation Research

Table 1 synthesizes the key variables and findings from the 12 reviewed TPB-based public transportation studies, demonstrating the inconsistent empirical results that motivate the proposed extension.

The synthesis in Table 1 reveals three important patterns. First, subjective norms show the most inconsistent results across the reviewed studies: they are found to be significant in some contexts (Bamberg et al., 2007); (Shaheen, 2022); (Ambak et al., 2016) but not in others (Eriksson & Forward, 2011); (Donald et al., 2014); (Zailani et al., 2016); (Ibrahim et al., 2020). Second, extended variables—including personal norms (Bamberg et al., 2007), habit (Chen & Chao, 2011), trust (Ibrahim et al., 2020), and satisfaction (Fu & Juan, 2017) —all improve explanatory power, suggesting that the standard TPB model is systematically incomplete. Third, no study has incorporated Hofstede's cultural dimensions or designed a stimulus variable based on cultural orientation, confirming the research gap addressed in this study.

Table 1. Summary of Extended TPB Research on Public Transportation Use Intention

No.	Author(s)	Extended Variables	Key Finding
1	(Bamberg et al., 2007)	Personal norm, social norm, guilt, problem consequence	Personal norms are the most dominant predictor of public transport use; attitude, SN, and PBC have no influence
2	(Eriksson & Forward, 2011)	Descriptive norm added to TPB	Attitude and PBC significant for bus use intention; Subjective and Descriptive Norms not significant
3	(Chen & Chao, 2011)	Habit added to TPB	Habitual private vehicle use negatively affects intention to switch; habit–attitude relationship not significant
4	(Donald et al., 2014)	Moral norm, descriptive norm, environmental concern	Attitude and PBC significant; subjective norm and descriptive norm not significant
5	(Zailani et al., 2016)	Overall image and past behavior	Attitude, PBC, and overall image significant; subjective norm is the only TPB construct with no effect
6	(Lo et al., 2016)	Descriptive norm, personal norm, habit	Attitude, descriptive norm, and PBC related to travel mode intention
7	(Shaheen, 2022)	Personal norm, descriptive norm	Personal norms and subjective norms significant for public transport usage
8	(Ambak et al., 2016)	Behavior added to TPB	Attitude, SN, and PBC determine user intention; attitude is the most dominant factor
9	(Fu & Juan, 2017)	Satisfaction, habit	Attitude, subjective norm, satisfaction, and habit all significant
10	(Shaaban & Maher, 2019)	Intention and attitude differentiated by purpose (work/leisure)	PBC and subjective norms most dominant; purpose-specific differences found
11	(Ibrahim et al., 2020)	Trust added to TPB	Trust positively affects attitude and PBC; subjective norm has no effect on intention
12	(Ng & Phuong, 2021)	Environmental concern, descriptive norm, personal norm, service satisfaction	Environmental concern affects attitude, SN, PBC; attitude, SN, PBC, descriptive norm, and service satisfaction all significant

PBC = Perceived Behavioral Control; SN = Subjective Norm.
Source: Authors' systematic review (2022)

4.1.2 Bibliometric Meta-Analysis: Scarcity of Culture-Integrated Public Transportation Research

A bibliometric meta-analysis of 275 journal articles using the keyword 'cultural public transportation' generated a keyword co-occurrence network with nine thematic clusters. Large clusters correspond to frequently researched themes, such as system, analysis, service, quality, transportation, and public transportation, whereas small clusters represent marginally studied themes. The keywords 'cultural aspects' and 'cultural factors' appear only in small-sized nodes at the periphery of the network, confirming that public transportation studies integrating cultural dimensions are significantly underrepresented relative

to system-oriented, service quality-oriented, and demand analysis-oriented studies. Most critically, no cluster in the meta-analysis connects the keyword 'culture' with " Hofstede, confirming that the specific application of Hofstede's cultural dimension framework to public transportation research is a genuinely novel contribution.

4.1.3 Proposed Integrated TPB-SOR Research Model

Based on the research gap analysis and theoretical frameworks reviewed, this study proposes an integrated model connecting culture-based public transportation (as SOR stimulus) to attitude, subjective norm, and perceived behavioral control (as TPB organism variables), and use intention (as SOR response). The following seven hypotheses are proposed for empirical testing.

- H_1: Culture-based public transportation has a significant positive effect on attitudes toward using public transportation.
- H_2: Culture-based public transportation has a significant positive effect on subjective norms for public transportation use.
- H_3: Culture-based public transportation has a significant positive effect on perceived behavioral control when using public transportation.
- H_4: Attitude toward public transportation has a significant positive effect on the intention to use public transportation.
- H_5: Subjective norms have a significant positive effect on the intention to use public transportation.
- H_6: Perceived behavioral control has a significant positive effect on the intention to use public transportation.
- H_7: Attitude, subjective norms, and perceived behavioral control significantly mediate the relationship between culture-based public transportation and the intention to use public transportation.

The integrated model positions culture-based public transportation as a stimulus-response (SOR) stimulus operating upstream of the standard TPB organism variables. When public transportation users perceive that services have been designed with their cultural context in mind—honoring their space preferences (individualism-collectivism), punctuality standards (uncertainty avoidance), social status signaling (power distance), efficiency expectations (masculinity), and experience orientation (time orientation)—they develop more favorable attitudes, perceive stronger social normative support, and experience greater behavioral control confidence, all of which directly increase their intention to use the service.

4.2 Discussion

The proposed integrated TPB-SOR-culture model addresses the three specific limitations identified in the literature. First, it resolves the absence of a stimulus problem: the standard TPB has no mechanism for incorporating external environmental design factors that trigger attitude and norm formation. The SOR model supplies this mechanism: culture-based transportation design functions as the stimulus that activates the TPB organism responses. This is theoretically consistent with Mehrabian and Russell's (1974) original SOR formulation and its marketing applications.

Second, the model addresses the cultural heterogeneity gap in Indonesian transportation studies. Indonesia's multicultural user population is not a homogeneous group whose transportation needs can be addressed by a single universal service design. Hofstede's five cultural dimensions provide a theoretically grounded, empirically validated framework for understanding the specific preference dimensions—spatial preferences, predictability needs, status consciousness, efficiency expectations, and experience orientation—that vary systematically across Indonesia's diverse cultural groups. This differentiation was absent

in all 12 reviewed studies.

Third, the model is practically applicable. Unlike attitudinal or norm-based interventions, which require sustained behavioral change campaigns, culture-based transportation design translates directly into specific service design decisions: seating configurations that respect spatial norms, scheduling systems that reduce uncertainty, branding and aesthetic elements that resonate with cultural identity, and multi-class service options that accommodate social status differences. These design decisions provide public transportation operators with a concrete implementation pathway for the theoretical insights generated by the model.

The bibliometric meta-analysis findingthat no study systematically connects Hofstede's cultural framework to public transportation researchsupports the novelty of this contribution. Public transportation adoption research has historically focused on service attributes (reliability, cost, time), infrastructure (routes, coverage, connectivity), and behavioral attitudes without examining the cultural fit dimension, which may be critical for achieving a meaningful mode shift in multicultural societies such as Indonesia.

5. Conclusions

This systematic literature review developed a conceptual model extending the Theory of Planned Behavior to explain public transportation use intention in Indonesia by incorporating culture-based public transportation as a stimulus variable through the SOR framework. Four main conclusions emerged. First, twelve reviewed TPB studies produced inconsistent findings on subjective, descriptive, and personal norms, highlighting the need for a coherent stimulus variable. Second, a meta-analysis of 275 articles confirms culture-integrated public transportation research is scarce, with no study applying Hofstede's cultural dimensions. Third, culture-based public transportation is proposed as a valid and actionable SOR stimulus, aligned with Hofstede's five dimensions to match users' cultural preferences. Fourth, the integrated TPB-SOR-culture model generates seven testable hypotheses linking culture-based transportation design through attitude, subjective norm, and perceived behavioral control to use intention, providing a structured agenda for empirical validation in Indonesia.

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Author Contributions

PW was responsible for the conceptualization of the study, design of the research methodology, data collection, field observations, analysis of cargo handling processes in airline operations, literature review, manuscript preparation, and participated in reviewing and finalizing the manuscript.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this study. This research was conducted independently, and no financial or personal relationships influenced the results or interpretation of the findings.

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