A Comparative Analysis on the Impact of Culture, Norms and Attitudes on the Adoption of Eco-Friendly Transportation in Mannheim and Tokyo

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1 ABSTRACT

In the conversation on eco-friendly practices, the role of cultural values, norms, and attitudes as to sustainable urban transportation remains crucial yet still understudied. A lot of work has been done to identify the facets of sustainable transportation, yet there exists a gap of how culture elements shape the adoption and effectiveness of eco-friendly practices (Brown & Wang, 2018). This exploratory comparative qualitative research in progress investigates the key indicators derived from cultural values, norms, and attitudes on the adoption and effectiveness of eco-friendly transportation practices in Germany (such as Freiburg) and Japan (such as Tokyo).

Keywords: adoption, attitudes, social norms, culture, sustainable transportation

2 INTRODUCTION

Transportation is the spine to the development of urban areas (Chattaraj and Ujjal, 2003). From walking to public transportation and then varieties of automobiles, factors such as economic development, creativity and availability of high technology have been the reasons behind the tremendous advancement in urban transportation. Urban transportation may be referred to as transfer (of people and goods) system that embraces all elements of transportation, including the infrastructure, rolling stock, and traffic flows, in a city as a functioning entity. Its elements include Metro-Subway-System; Bus System; Shuttle System; Transit rail System; Paratransit System; Taxi System; Private vehicles; Cycling; walking; and others. Factors such as culture, cost, comfort, distance, safety, and journey duration determine the choice of paths in the development of urban transportation planning. According to United Nations (2018), urban transportation increased from 2% in 1800 to 50.16% in 2007 and it is expected to reach 68.36% in 2050. In the era of sustainable urban living and eco-friendly practices, it is important to understand the cultural underpinnings of transportation choices which has become increasingly apparent (Doe & Johnson, 2021). Germany and Japan portray diverse cultural values and different approaches to smart cities' development. Analyzing the cultural fabrics of Freiburg and Tokyo, this research strives to fill the gap highlighting the influence of social norms, examining carefully decision-making processes, and evaluating the cultural sensitivity embedded in community engagement narratives (Wong & Kim, 2018; Patel et al., 2019) which influence transportation behaviors and policies. Tokyo is densely populated with urban transportation systems such as Tokyo Metro; JR East (Japan Railways East); Japan Railways (JR) Toei Subway; Buses; Tokyo Monorail; Tokyo Water Bus; Taxis; Cycling; Walking; Car Rentals and Car-sharing Services etc.

3 RESEARCH AIM

To systematically examine and understand the interplay between cultural and social dimensions shaping the adoption of sustainable transportation practices in Germany (Freiburg) and Japan (Tokyo).

4 SYSTEMIC LITERATURE REVIEW: THE IMPACT OF CULTURAL VALUES, SOCIAL NORMS AND INDIVIDUAL ATTITUDES

4.1 Initial Research Gap

Very little has been done on how cultural, norms and human behavior shape the adoption of sustainable transportation (Sedita, 2020). Some discovery of not having enough data on aged drivers, unavailability of bigger sample sizes, and no existence of psychological data on behavior (Mohapatra et. al., 2023).

4.2 Acceptance of Eco-friendly Practices

Culture shapes individual behaviors and societal structures (Smith et al., 2020; Jones & Lee, 2019). Many studies have examined the effect of culture on sustainable development but very little has been done on how

human behavior shapes the adoption of sustainable transportation (Sedita, 2020). There is a current lack of knowledge on aged drivers, unavailability of bigger sample sizes, and no psychological data exist on behavior (Mohapatra et. al., 2023). Therefore, this research investigates how cultural dimensions influence sustainable transportation adoption and outcomes in Germany and Japan. Germany and Japan portray diverse cultural values and also show different smart city development methods. Analyzing the cultural fabric of Germany and Japan will display the role of culture in influencing transportation behaviors and policies. To fill the gap, the work researches on the influence of social norms, and examine decision-making processes, as well as the role of cultural sensitivity embedded in community engagement narratives (Wong & Kim, 2018; Patel et al., 2019). The extent to which culture explains transportation choices (Doe & Johnson, 2021) and fosters eco-friendly transportation practices and its success implications will be investigated. By exploring how societal expectations and peer influences mold transportation choices, the study aims to model the role of social conformity and divergence in shaping sustainable mobility patterns in Germany and Japan. Individual attitudes toward transportation, influenced by personal beliefs, experiences, and perceptions, play a pivotal role in shaping sustainable mobility behaviors. This study conceptualizes how individuals in Germany and Japan perceive and respond to eco-friendly transport practices. By examining individual attitudes, the research aims to discern the factors that contribute to or impede the acceptance of sustainable transportation options. The effectiveness of eco-friendly transport practices is measured not only by their environmental impact but also by their integration into the daily routines of urban dwellers. This research conceptualizes effectiveness as a multidimensional construct, encompassing factors such as adoption rates, behavioral changes, and the overall success of sustainable transportation policies in both Germany and Japan. The acceptance of eco-friendly transport practices involves the embrace of sustainable transport as a cultural norm. This research conceptualizes acceptance as a holistic concept, considering factors such as public perception, willingness to adopt, and the integration of eco-friendly transport practices into the broader societal fabric.

At this stage, the research methodology comprises a systematic and an additional narrative literature review. Regarding the systematic literature review, an online database search was conducted with the following key words: sustainable practices; social dimensions; culture; and urban transportation. Initially, seventeen thousand and six hundred (17,600) articles were identified. Two-hundred and twelve (212) titles were selected but ninety-seven (97) articles were selected for relevance. Twenty-e (19) articles were selected for full text review, out of which nineteen (13) passed the inclusion and exclusion criteria Finally, only eleven (11) articles passed the quality assessment process adapted, thus, validity, credibility, reliability, and integrity. An additional narrative literature review, to assure the consideration of most updated research, was conducted on specific relevant research in German and Japanese cities. The extraction process resulted in initial conceptualizations which will be presented at the conference. In addition, based on the initial conceptualizations, a research design for a consecutive, comparative empirical study is suggested favoring a mixed method triangulation approach.

4.3 Selection Criteria

Time frame: The time framework for this study was set from the genesis of sustainability by the United Nations in 1984 until 2023, to identify enough indicators that drive sustainable urban transportation.

Language: English, due to the language limitations of the researcher.

Study topic: The researcher terminated studies with zero value to the research questions for final selection and included necessary research papers to achieve the aim of this study.

Study type: For high quality information, this study eliminated all relevant literature external to the primary classification.

Methodology: Qualitative methodology.

4.4 Quality Assessment

Validity – focused on the accuracy and potency of the study measurement in respect of the research questions for this study.

Reliability – the replicability and the degree of usability of the result now and the future.

Credibility – the requisite academic qualification to be able to carry out the research. Moreso the impact factor of the journal into which the studies were published.

Integrity – research that constitute trust and confidence in the methods applied and the findings.

4.5 Flow Chart
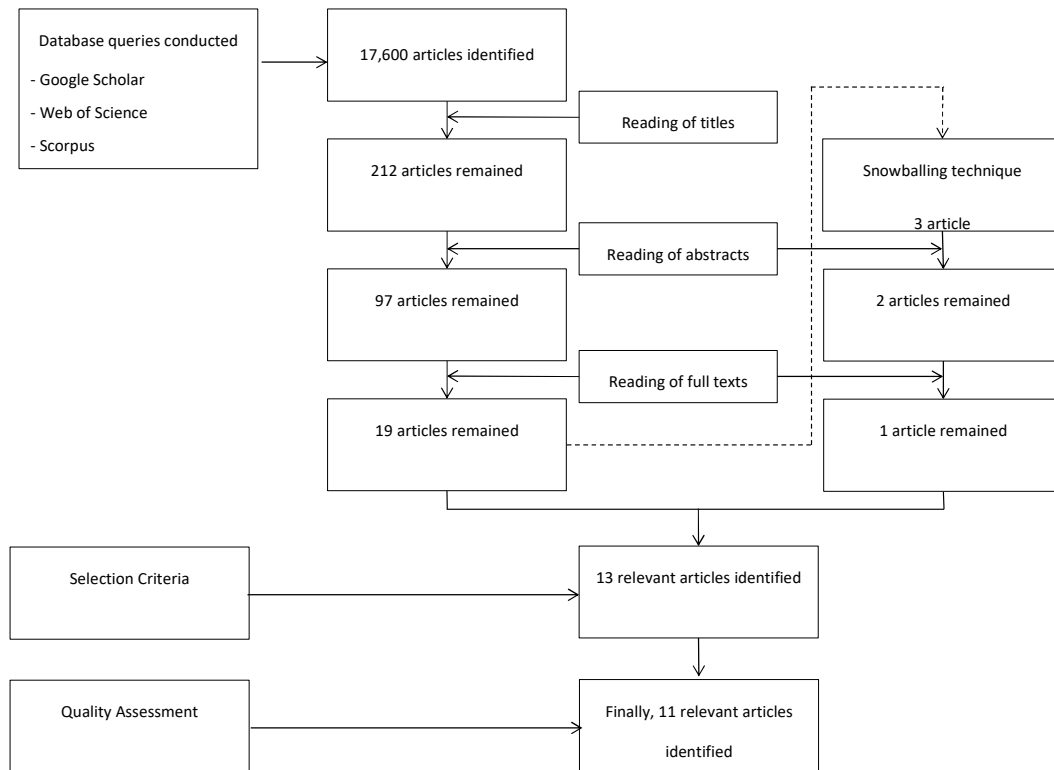
4.6 Data Extract Form

No# of study	Title	Author/s	Publication	Year of publication	Methodology	Population	Results
1.	The effect of transport infrastructure (road, rail, and air) investments on economic growth and environmental pollution and testing the validity of EKC in China, India, Japan, and Russia	Yuanhao Liu Arshad Ali Yuanchun Chen Xiao She	Environmental Science and Pollution Research (2023) 30:32585–32599 https://doi.org/10.1007/s11356-022-24448-w	December 2022	Qualitative Method	Japan China Russia India	The development of infrastructure through revolutionary technologically pro- ficient and advanced transportation systems can improve environmental quality by reducing energy consumption in transportation and resource use (De Souza et al. 2018; Koh et al. 2020). Asian countries should subsidize private R&D activities to increase the affordability of supply of clean energy and renewable investment projects.
2.	Urbanism as it should be: An overview of Environmental Urban Movements and Initiatives towards Sustainability.	Waala A. Yakoub, Mahmoud F. Mahmoud, Osama M. Abo El-Enein, Ghada M. Elrayies	Second International Conference (Tenth Conference of Sustainable Environmental Development), Sharm El Sheikh, Egypt (pp. 16-20).	March 2019	Qualitative Method	Eleven (11) types of eco-friendly urbanism	This study resulted in concept of "a conservation- oriented and environment-friendly society", which can be achieved by applying a new policy emphasized on "harmony between humanity and nature" has emerged.
3.	Sustainable Urban Transportation Criteria and Measurement — A Systematic Literature Review. Sustainability	Kraus Lisa, Heike Proff	Journal for Sustainability, Volume 13, Issue 13: 7113. https://doi.org/10.3390/su13137113	June 2021	Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)	21 papers from journals listed in the German rating system JOURQUAL3 (JQ3) and published between 2010 and 2020.	The research confirmed with the supposition that the environment is of existential importance to social and economic dimensions
4.	Incorporating energy efficiency in urban planning: a review of policies and best practices	Aniekan Akpan Umoh, Peter Efosa Ohenhen, Onyinyechukwu Chidolue, Bright Ngozichukwu, Adetomilola Victoria Fafure, and Kenneth	Engineering Science & Technology Journal P-ISSN: 2708-8944, E-ISSN: 2708-8952, Volume 5, Issue 1, P.No. 83-98, January 2024 DOI: 10.51594/estj/v5i1.729	January 2024	Qualitative Method	Tokyo Vancouver Copenhagen Singapore	Future urban planning initiatives should prioritize the seamless integration of energy-efficient policies into broader urban development strategies. Rather than treating energy efficiency as a standalone aspect, it should be woven into the fabric of comprehensive policies that address

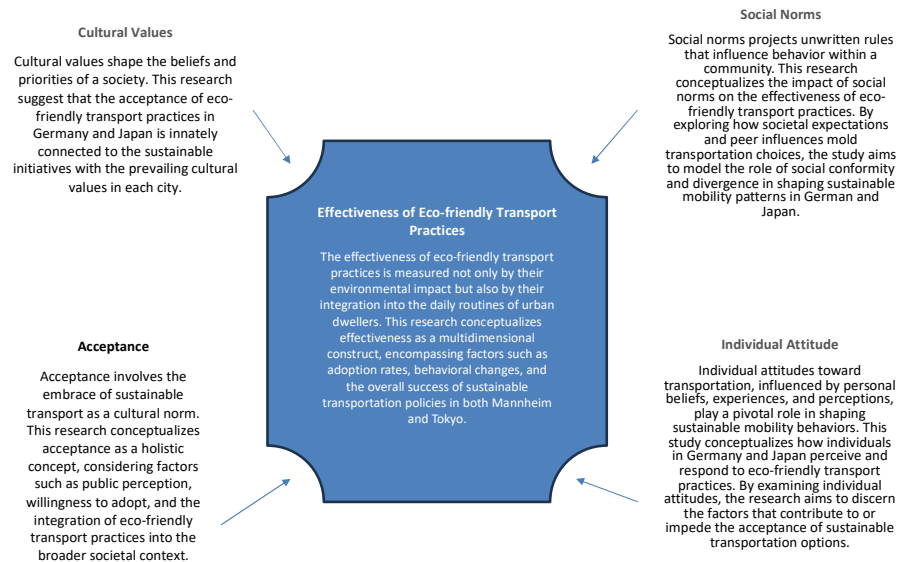| No# of study	Title	Author/s	Publication	Year of publication	Methodology	Population	Results
5.	Pedestrian Behavior in Japan and Germany: A Review	Lorena Hell, Janis Sprenger, Matthias Klusch, Yoshiyuki Kobayashi, and Christian Müller	German Research Center for Artificial Intelligence (DFKI)	July, 2001	Quantitative Method	Japan and Germany	For the application of autonomous driving, this is of utmost importance. It is not sufficient to consider the differences in regulations and infrastructure, but in the culturally influenced behavior in general. Research on pedestrian behavior should be always considered in the cultural context of the study and more research of the cultural differences of pedestrian be-havior is required to enable autonomous vehicles to interact safely and reasonably with pedestrians in different countries.
6.	The cultural barriers to a low-carbon future: A review of six mobility and energy transitions across 28 countries	Benjamin K. Sovacool, and Steve Griffiths	Renewable and Sustainable Energy Reviews 119 (2020) 109569	March, 2020	Qualitative Method	28 countries	Culture demands new forms of research and the input of local communities into the research and planning process as well. In the government, policymaking, and planning domains, ministries and statistical agencies responsible for energy, climate, and buildings should begin to collect data on culture and cultural trends. Governments to stipulate greater community involvement during licensing and permitting discussions so that cultural bias is minimized. Group-based and collective phenomena—such as culture—shape and influence aspirations, capabilities, and agency for low-carbon transitions
7.	An Eco-Friendly Multimodal Route Guidance System for Urban Areas Using Multi-Agent Technology	Abdallah Namoun, Ali Tufail, Nikolay Mehandjiev, Ahmed Alrehaili, Javad Akhlaghinia, Evtim Peytchev	Appl. Sci. 2021, 11, 2057. https://doi.org/10.3390/app11052057	February, 2021	Quantitative Method	Nottingham (UK), Sofia (Bulgaria)	Our validation results demonstrate the effectiveness of personalized multimodal route guidance in inducing a positive travel behavior change and the ability of the agent-based route planning system to scale to satisfy the requirements of traffic infrastructure in diverse

No# of study	Title	Author/s	Publication	Year of publication	Methodology	Population	Results
8.	The Current Status of Hydrogen Energy Industry and Application of Hydrogen Fuel Cell Vehicles	Mile Zhao	Highlights in Science, Engineering and Technology, Volume 59, 97-102.	July, 2023	Qualitative Method	China, and Japan	Hydrogen energy is becoming more popular as a clean supplemental energy source as the shift to a low-carbon energy framework is accelerated globally. Hydrogen vehicles are more environmentally friendly and convenient to get energy than conventional fossil fuel powered automobiles.
9.	Eco-Cities — A Global Survey 2011	Simon Joss, Daniel Tomozeiu, Robert Cowley	University of Westminster International Eco-Cities Initiative	September, 2011	Qualitative Method	178 countries from the globe	Freiburg (Germany) and St. Davids (United Kingdom) are vying to be the 'greenest city' of Europe, …with international projects such as Tianjin Binhai Eco-city and the four eco-cities planned in the Delhi-Mumbai Industrial Corridor with input from Japan
10.	Introduction to Sustainable Transportation. Policy, Planning and Implementation (2nd edition)	Preston L. Schiller, Jeffrey Kenworthy	Journal of International Planning Studies	November, 2017	Qualitative Method	USA	The book concludes with a discussion of the most vital actions, preparations and measures that need to be taken at several levels to move from conventional to sustainability ransportation. For example, the need for leaders who lead; citizens who participate in effective and well informed ways, often 'leading their leaders'; NGOs and transportation pro fes – sionals, including academics, as well as government institutions that are transformed and move in a more sustainable direction for the 'long haul'.
11.	How is a Sustainable Society Established? : A Case Study of Cities in Japan and Germany	Tsuyoshi Sato	EVERGREEN Joint Journal of Novel Carbon Resource Sciences & Green Asia Strategy, Vol. 03, Issue 02, pp. 25-35	September, 2016	Qualitative Methos	Kitakyushu (Japan) and Emscher (Germany)	The comparative investigations into their revitalization periods uncovered three commonalities: the presence of a symbol of an environmentally friendly society; a regional organization that manages projects with a comprehensive view; and the use of regional tangible and intangible resources created in the

| 12. | Conditions of success in sustainable urban transport policy change in 'relatively successful' European cities | Stefan Bratzel | Transport Reviews https://doi.org/10.1080/0144 16499295600 | November 2010 | Qualitative Method | Zurich, Basle (Switzerland), Amsterdam, Groningen (The Netherlands) and Freiburg (Germany). | Social crises and impressive political mandates were identified as important external factors that influenced the 'greening' of urban transport in the relatively successful cities. However, an open macro-window is only conceived as a political opportunity for change, a necessary but not sufficient condition. |
| 13. | Cultural dynamics and sustainable consumption: a perception of brazilian students in germany | Iveltyma Roosemalen Passos Ibiapina, Sérgio Henrique de Oliveira Lima, Áurio Lúcio Leocádio, and Diego Sampaio Vasconcelos Ramalho Lima | RGSA – Revista de Gestão Social e Ambiental: DOI: https://doi.org/10.24857/rgsa .v15i1.2714 | September 2021 | Qualitative Method | participant and non-participant observations and ten business students (six women) aged between 22 and 26 | Participants perceive the influence of cultural differences on their consumption behavior. In addition, both material culture (e.g., objects, institutions, and organizations) and language and communication systems (e.g., verbal and non-verbal communication) influence their sustainable consumption practices. Ultimately, this configures a dynamic process of adaptation to the new cultural context in which they live. |

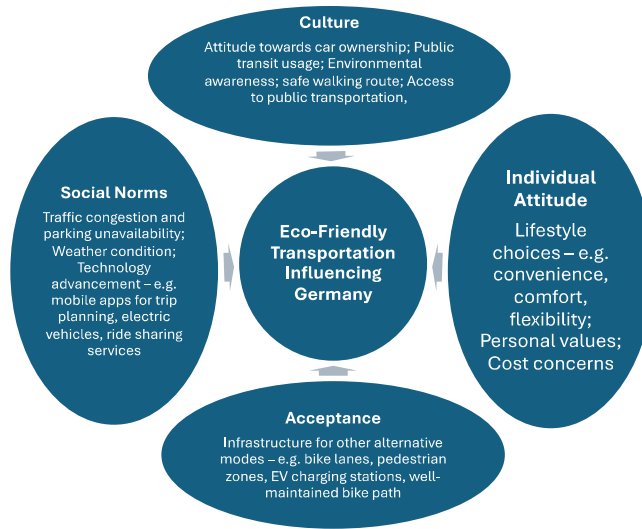# 5 INITIAL CONCEPTUALIZATION

5.1 Overall Factors

Initial Conceptualisation

Cultural Values

Cultural values shape the beliefs and priorities of a society. This research suggest that the acceptance of eco-friendly transport practices in Germany and Japan is innately connected to the sustainable initiatives with the prevailing cultural values in each city.

Social Norms

Social norms projects unwritten rules that influence behavior within a community. This research conceptualizes the impact of social norms on the effectiveness of eco-friendly transport practices. By exploring how societal expectations and peer influences mold transportation choices, the study aims to model the role of social conformity and divergence in shaping sustainable mobility patterns in German and Japan.

Effectiveness of Eco-friendly Transport Practices

The effectiveness of eco-friendly transport practices is measured not only by their environmental impact but also by their integration into the daily routines of urban dwellers. This research conceptualizes effectiveness as a multidimensional construct, encompassing factors such as adoption rates, behavioral changes, and the overall success of sustainable transportation policies in both Mannheim and Tokyo.

Acceptance

Acceptance involves the embrace of sustainable transport as a cultural norm. This research conceptualizes acceptance as a holistic concept, considering factors such as public perception, willingness to adopt, and the integration of eco-friendly transport practices into the broader societal context.

Individual Attitude

Individual attitudes toward transportation, influenced by personal beliefs, experiences, and perceptions, play a pivotal role in shaping sustainable mobility behaviors. This study conceptualizes how individuals in Germany and Japan perceive and respond to eco-friendly transport practices. By examining individual attitudes, the research aims to discern the factors that contribute to or impede the acceptance of sustainable transportation options.

5.2 Initial conceptualizations: factors influencing in Japan and Factors influencing in Germany
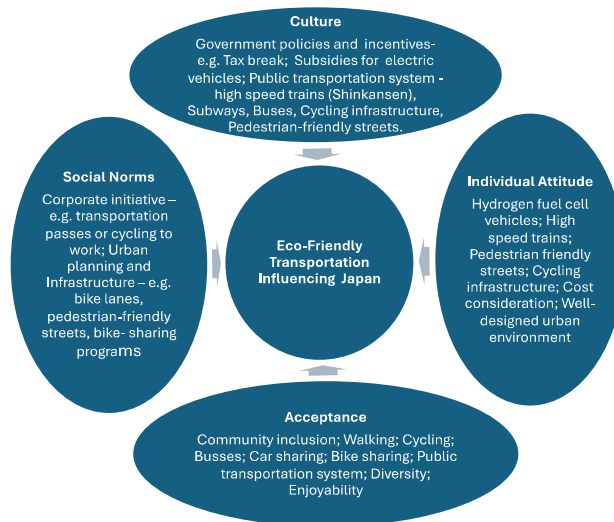
5.2.1 Factors in Germany

Factors Influencing In Germany

5.2.2 Factors in Japan

Factors Influencing In Japan

5.3 Summary of how the German and Japan Factors Differ

In summary, Germany and Japan prioritize eco-friendly transportation, their methodologies differ slightly due to differences in infrastructure, cultural norms, and government policies. Germany places emphasis on environmental awareness and policy incentives. Japan focuses on efficiency, technological innovation, and adaptability to its unique urban landscape and societal values.

6 RESEARCH DESIGN TABLE

Interlinking Research Objectives, Research Questions, Interview Questions, and Informing Sources – For the Quantitative Part

Research Objectives	Research Question	1. Research Interview	Sources
Conduct a comprehensive analysis to explore the cultural values prevalent in Japan and German and their impact on residents' perceptions of sustainable transportation options.	What are the key sustainable transportation policies implemented in Germany? What are the key sustainable transportation policies implemented in Japan?	1. Kindly describe the key sustainable transportation policies that have been implemented in Germany and elaborate on how these policies were introduced and integrated into the existing transportation framework? 2. Kindly describe the key sustainable transportation policies that have been implemented in Japan and elaborate on how these policies were introduced and integrated into the existing transportation framework? 3. What impacts or changes have been observed since the implementation of these policies? 4. How were the various local communities involved in the development and execution of sustainable transportation policies? 5. What difficulties or success factors were achieved in support and cooperation from the communities contributed to the effectiveness of the implemented policies?	(Brown and Wang, 2018); (Umoh et al., 2024); (Schiller, P.L., and Kenworthy, J., 2017); (Zhao, M., 2023); (Muchlsin, M., 2012); (Ibiapina et al., 2021); (Sato, T., 2016); (Hell, Sprenger, Klusch, Kobayashi, & Müller, 2021)
Investigate the role of social norms in shaping transportation choices, focusing on how these norms influence the adoption of eco-friendly practices in the urban contexts of Germany and Japan.	How do cultural and social dimensions in Germany influence residents' perceptions and attitudes toward sustainable transportation options? How do cultural and social dimensions in Japan influence residents' perceptions and attitudes toward sustainable transportation options?	6. How do cultural values in German shape residents' preferences and choices in transportation modes, and to what extent do these preferences influence sustainable transportation options? 7. How do cultural values in Japan shape residents' preferences and choices in transportation modes, and to what extent do these preferences influence sustainable transportation options?	(Schiller, P.L., and Kenworthy, J., 2017); (Zhao, M., 2023); (Hell, Sprenger, Klusch, Kobayashi, & Müller, 2021); (Sovacool, B. K., and Griffiths, S., 2020);
Analyze how cultural factors influence the decision-making processes of policymakers and urban planners concerning the development, implementation, and evaluation of sustainable transportation policies in Germany and Japan.	Which cultural and social dimensions shape the citizens' adoption of sustainable transportation practices and how do these norms differ between Germany and Japan?	8. Are there specific cultural factors that either facilitate or hinder the acceptance of eco-friendly modes of transportation?	(Zhao, M., 2023); (Muchlsin, M., 2012); (Ibiapina et al., 2021); (Schiller, P.L., and Kenworthy, J., 2017);
Evaluate the degree of cultural sensitivity incorporated into community engagement initiatives promoting sustainable transportation and assess its impact on the success of these initiatives in both Germany and Japan.	Which cultural and social dimensions hinder the citizen's' adoption of sustainable transportation practices, and how do these norms differ between Germany and Japan?	9. In your opinion, what role do social networks and interactions play in shaping people's decisions regarding the adoption of eco-friendly transportation options? 10. Are there social pressures or expectations that affect whether individuals choose sustainable transportation options, and if so, how do they manifest	(Hell, Sprenger, Klusch, Kobayashi, & Müller, 2021); (Sovacool, B. K., and Griffiths, S., 2020); Goldman, T., and Gorham, R. (2006)

7 METHODOLOGY

- Case Study Methodology: The study focuses on in-depth exploration of transportation policies of Freiburg and Tokyo and examines the real-life cultural situations in detail, to understand the complex phenomena within their natural context.

- Research objectives: Conduct a comprehensive analysis to explore the cultural values prevalent in Japan and German and their impact on residents' perceptions of sustainable transportation options; Investigate the role of social norms in shaping transportation choices, focusing on how these norms influence the adoption of eco-friendly practices in the urban contexts of Germany and Japan; Analyze how cultural factors influence the decision-making processes of policymakers and urban planners concerning the development, implementation, and evaluation of sustainable transportation policies in Germany and Japan; Evaluate the degree of cultural sensitivity incorporated into community engagement initiatives promoting sustainable transportation and assess its impact on the success of these initiatives in both Germany and Japan; to gather information about norms, opinions, attitudes, and behaviors and their effects on residents' perceptions of eco-friendly transport options. Additionally, the study will examine some key indicators of social norms influencing transportation choices and address how cultural elements shape decision-making among policymakers in creating sustainable transportation policies. toward eco-friendly transportation.

- Research Strategies: Case study; Survey; and Document analyses.- start with qualitative and then validate with quantitative research.

- Data collection method: Interviews; Fully structured questionnaire

- Time horizons: Cross sectional study

- Population: urban dwellers: Germany/Freiburg (236,140); Japan/Tokyo (37,194,000)

- Sampling Techniques: Convenient sampling (i.e. selection of Freiburg and Tokyo); Convenience sampling and significance testing (i.e. selection of cases)

- Sample size (based on online communities)

- Case Study: Twelve (12) to Fifteen (15) urban dwellers respectively in Freiburg and Tokyo;

- Survey: 500 online questionnaires

- Data analyses:
  - Qualitative: The study will use MAXQDA, a comprehensive qualitative data analysis software that supports various qualitative research techniques.

        o Quantitative: descriptive and explanatory; multivariate analysis (multiple regression analysis; SEM (Structured Equation Modelling), Cluster Analysis

- Ethical Consideration: The researcher will adopt ethical behavior such as voluntary participation in the research, keeping anonymity, destroying recorded data immediately after the analysis.

8 CONCLUSIONS

The adaption of eco-friendly transportation technology requires considering cultural factors beyond regulatory and infrastructural differences. Pedestrian behavior, for example, differs significantly across cultures, resulting in context-specific research to inform the design and deployment of eco-friendly transportation choices. Incorporating community viewpoints, in research policymaking and planning is crucial to foster development and tackle urgent societal issues. When it comes to eco-friendly transportation comprehending cultural subtleties becomes especially vital in ensuring the safety, acceptance and efficacy of emerging technologies. By encouraging participation from communities and prioritizing policies that promote conservation efforts societies can strive for a balanced connection, between humans and nature safeguarding the well-being of current and future generations. This approach will strengthen the legitimacy of policy interventions and also promote social cohesion and trust between stakeholders. The result of this research will contribute not only to the academic fraternity of smart city developments but also to the development of practical, indicative cultural strategies that can be applied in Freiburg, Tokyo, and serve as a

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