

**NUDGING TOWARDS SUSTAINABILITY: BEHAVIOURAL POLICY
APPROACH FOR SUSTAINABLE URBAN MOBILITY**

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**DEPARTMENT OF MANAGEMENT STUDIES
INDIAN INSTITUTE OF TECHNOLOGY DELHI**

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APPROACH FOR SUSTAINABLE URBAN MOBILITY**

by

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CERTIFICATE

This is to certify that the thesis titled “*Nudging Towards Sustainability: Behavioural Policy Approaches towards Sustainable Urban Mobility*” being submitted by *Sagarika Chaudhary* to the Department of Management Studies, Indian Institute of Technology Delhi for the award of the degree of **Doctor of Philosophy (Ph.D.)**, is a record of bonafide research work carried out by her. She has worked under our guidance and supervision and fulfilled the requirements for the submission of the thesis, which has attained the standard required for a Ph.D. degree of the institute. The results presented in the thesis have not been submitted elsewhere for award of any degree or diploma.



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“If I have seen further, it is by standing on the shoulders of giants.”

— **Isaac Newton**

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ABSTRACT

Rapid urbanisation, rising motorisation, and increasing dependence on private vehicles have intensified transport-related emissions, congestion, and public health concerns across cities worldwide. In this context, promoting sustainable urban mobility has emerged as a critical policy priority. However, despite technological advancements and infrastructure investments, behavioural resistance remains a major barrier to the adoption of sustainable transport modes. Travel choices are not driven solely by economic or infrastructural factors; they are deeply embedded in social norms, individual attitudes, perceptions, and contextual influences. Recognising this, the present thesis adopts a behavioural policy perspective to examine how social and behavioural factors shape mobility behaviour and how targeted informational nudges can influence sustainable transport choices, particularly the adoption of electric vehicles (EVs).

Titled *Nudging Towards Sustainability: Behavioural Policy Approaches towards Sustainable Urban Mobility*, this thesis aims to bridge the gap between behavioural theory and policy practice by systematically identifying behavioural determinants of mobility behaviour, empirically estimating their effects, and experimentally evaluating low-cost behavioural interventions. The overarching objective is to generate evidence-based insights that can inform the design of effective, scalable, and context-sensitive mobility policies.

The research is structured around three interlinked empirical studies, each addressing a distinct but complementary research objective. Together, these studies provide a comprehensive and sequential understanding of sustainable mobility behaviour, moving from theory-building to empirical validation and policy experimentation.

The first study employs a meta-analytical approach to synthesise existing empirical evidence on the social and behavioural determinants of transport mode choice. An extensive systematic literature review was conducted, covering peer-reviewed journal articles published between 1990 and 2024 and indexed in major academic databases, including Scopus, Web of Science, and JSTOR. Stringent inclusion and exclusion criteria were applied to ensure methodological robustness and comparability, resulting in a final sample of 45 high-quality studies. Using a random-effects meta-analysis framework, the study calculates pooled effect sizes to account for heterogeneity across geographical contexts, study designs, and population groups.

The findings from the meta-analysis reveal that behavioural factors exert a substantial and statistically significant influence on mobility behaviour. Environmental concern, personal attitudes towards sustainability, social norms, and environmental knowledge emerge as the most consistent and influential determinants of sustainable mode choice. By consolidating fragmented empirical evidence, this study establishes a robust theoretical foundation and directly addresses the first research objective: identifying key social and behavioural factors influencing mobility behaviour.

Building on the theoretical insights derived from the meta-analysis, the second study advances to empirical modelling using primary survey data and structural equation modelling (SEM). This study seeks to quantify the pathways through which behavioural determinants influence sustainable mobility intentions, thereby addressing the second research objective. Primary data were collected from respondents across urban regions of Delhi, India, capturing detailed information on attitudes, social norms, environmental concern, perceived behavioural control, and intentions to adopt sustainable transport modes such as EVs and public transport.

Grounded in the Theory of Planned Behaviour, the SEM framework enables the simultaneous estimation of multiple relationships between latent constructs. The model specification incorporates validated multi-item scales and demographic controls to enhance explanatory power. The results indicate that environmental concern exerts the strongest direct influence on sustainable mobility intentions. Social norms and attitudes contribute both directly and indirectly, interacting with environmental concern to shape behavioural intentions. The findings highlight that behavioural determinants do not operate in isolation; rather, they form an interconnected system in which perceptions of environmental responsibility, social expectations, and perceived feasibility collectively drive decision-making. This study deepens the mechanistic understanding of mobility behaviour and provides empirical validation of behavioural theories within a transport policy context.

The third and final study translates these behavioural insights into a policy-relevant experimental setting by evaluating the effectiveness of informational nudges using econometric modelling. Employing a randomised experimental design, respondents were assigned to a control group or one of three treatment groups receiving distinct informational nudges: a cost nudge, an environmental nudge, and a health nudge. The outcome of interest was binary mode choice between a conventional car and an electric vehicle.

An econometric regression framework was adopted to estimate the probability of choosing an EV while controlling for socio-demographic factors such as age, gender, income, and vehicle ownership. Marginal effects were computed to facilitate intuitive interpretation of treatment impacts. The experimental results demonstrate that informational nudges significantly influence mobility choices, with the environmental nudge emerging as the most effective intervention. This finding aligns closely with insights from the earlier studies, reinforcing the central role of environmental concern as a behavioural driver.

The econometric analysis confirms that well-designed informational interventions can meaningfully alter transport choices even in the absence of financial incentives or regulatory mandates. The superiority of the environmental nudge underscores the importance of aligning policy messaging with deeply held values and concerns, rather than relying solely on cost-based arguments. This study directly addresses the third research objective by providing causal evidence on the effectiveness of behavioural interventions in promoting sustainable mobility.

Collectively, the three studies form a coherent and integrated research framework. The meta-analysis identifies key behavioural determinants, the SEM quantifies their relationships and pathways, and the econometric experiment tests their practical applicability through targeted interventions. The consistency of findings across methodologies strengthens the validity of the conclusions and demonstrates the value of a mixed-methods quantitative approach.

The thesis makes several important theoretical and policy contributions. Theoretically, it advances behavioural transport research by synthesising global evidence, empirically validating behavioural models, and linking them to experimental policy tools. From a policy perspective, the research highlights the potential of low-cost, scalable informational nudges as complements to traditional transport policies. It suggests that sustainable mobility strategies should prioritise environmental messaging, social norm activation, and perceived behavioural feasibility to achieve meaningful behavioural change.

In conclusion, this thesis demonstrates that sustainable urban mobility transitions require not only technological and infrastructural solutions but also a nuanced understanding of human behaviour. The research provides a comprehensive and evidence-based framework for designing effective behavioural transport policies. The findings offer valuable insights for researchers, policymakers, and urban planners seeking to accelerate the shift towards sustainable, low-carbon urban mobility systems.

सार

तेजी से हो रहे शहरीकरण, बढ़ती मोटर वाहनों की संख्या तथा निजी वाहनों पर बढ़ती निर्भरता ने विश्वभर के शहरों में परिवहन से संबंधित उत्सर्जन, यातायात जाम और सार्वजनिक स्वास्थ्य संबंधी समस्याओं को गंभीर बना दिया है। इस परिप्रेक्ष्य में सतत शहरी गतिशीलता को बढ़ावा देना एक महत्वपूर्ण नीतिगत प्राथमिकता के रूप में उभरा है। हालांकि, तकनीकी प्रगति और आधारभूत संरचना में निवेश के बावजूद, व्यवहारिक प्रतिरोध सतत परिवहन विकल्पों के अपनाने में एक प्रमुख बाधा बना हुआ है। यात्रा से संबंधित निर्णय केवल आर्थिक या अवसंरचनात्मक कारकों से प्रभावित नहीं होते, बल्कि वे सामाजिक मान्यताओं, व्यक्तिगत दृष्टिकोण, धारणाओं और संदर्भगत प्रभावों में गहराई से निहित होते हैं।

इसी को ध्यान में रखते हुए, प्रस्तुत शोध “सततता की ओर प्रेरित करना: सतत शहरी गतिशीलता के लिए व्यवहारिक नीति दृष्टिकोण” शीर्षक के अंतर्गत, यह विश्लेषण करता है कि सामाजिक एवं व्यवहारिक कारक किस प्रकार गतिशीलता व्यवहार को प्रभावित करते हैं तथा लक्षित सूचना-आधारित “नज” किस प्रकार सतत परिवहन विकल्पों, विशेषकर विद्युत वाहनों (EVs), के अपनाने को प्रोत्साहित कर सकते हैं। इस शोध का मुख्य उद्देश्य व्यवहारिक सिद्धांत और नीतिगत व्यवहार के बीच की खाई को पाटना, व्यवहारिक निर्धारकों की पहचान करना, उनके प्रभावों का अनुभवजन्य आकलन करना तथा कम लागत वाले व्यवहारिक हस्तक्षेपों का परीक्षण करना है।

यह शोध तीन परस्पर संबंधित अनुभवजन्य अध्ययनों पर आधारित है, जो क्रमशः सैद्धांतिक निर्माण, अनुभवजन्य सत्यापन और नीतिगत प्रयोग के माध्यम से सतत गतिशीलता व्यवहार की व्यापक समझ प्रस्तुत करते हैं।

प्रथम अध्ययन में परिवहन माध्यम चयन के सामाजिक एवं व्यवहारिक निर्धारकों का समेकित विश्लेषण करने हेतु मेटा-विश्लेषण पद्धति का उपयोग किया गया है। इसके अंतर्गत 1990 से 2024 के बीच प्रकाशित 45 उच्च गुणवत्ता वाले शोध अध्ययनों का चयन कर, रैंडम-इफेक्ट्स मॉडल के माध्यम से संयुक्त प्रभाव आकार का आकलन किया गया। निष्कर्ष दर्शाते हैं कि पर्यावरणीय चिंता, व्यक्तिगत दृष्टिकोण, सामाजिक मान्यताएँ तथा पर्यावरणीय ज्ञान सतत परिवहन विकल्पों को अपनाने में महत्वपूर्ण एवं सांख्यिकीय रूप से प्रभावी कारक हैं।

द्वितीय अध्ययन में संरचनात्मक समीकरण मॉडलिंग के माध्यम से प्राथमिक सर्वेक्षण आंकड़ों का उपयोग करते हुए इन व्यवहारिक निर्धारकों के बीच संबंधों और उनके प्रभाव मार्गों का विश्लेषण किया गया है। दिल्ली के शहरी क्षेत्रों से एकत्रित आंकड़ों के आधार पर यह पाया गया कि पर्यावरणीय चिंता सतत गतिशीलता की मंशा पर सबसे अधिक प्रत्यक्ष प्रभाव डालती है। सामाजिक मान्यताएँ और व्यक्तिगत दृष्टिकोण भी प्रत्यक्ष एवं अप्रत्यक्ष दोनों रूपों में महत्वपूर्ण भूमिका निभाते हैं। यह अध्ययन दर्शाता है कि ये सभी कारक एक परस्पर जुड़े हुए तंत्र के रूप में कार्य करते हैं।

तृतीय अध्ययन में व्यवहारिक अंतर्दृष्टियों को नीतिगत प्रयोग के रूप में लागू करते हुए सूचना-आधारित “नज” की प्रभावशीलता का मूल्यांकन किया गया है। एक यादृच्छिक नियंत्रित प्रयोग के अंतर्गत प्रतिभागियों को नियंत्रण समूह तथा तीन उपचार समूहों (लागत, पर्यावरण और स्वास्थ्य आधारित नज) में विभाजित किया गया। परिणामस्वरूप यह पाया गया कि पर्यावरण-आधारित नज सबसे अधिक प्रभावी है और यह विद्युत वाहनों के चयन की संभावना को महत्वपूर्ण रूप से बढ़ाता है।

समग्र रूप से, यह शोध दर्शाता है कि सुव्यवस्थित सूचना-आधारित हस्तक्षेप बिना किसी वित्तीय प्रोत्साहन के भी व्यवहार परिवर्तन ला सकते हैं। तीनों अध्ययनों के निष्कर्षों में सामंजस्य इस शोध की वैधता को और सुदृढ़ करता है।

यह शोध सैद्धांतिक तथा नीतिगत दोनों स्तरों पर महत्वपूर्ण योगदान देता है। सैद्धांतिक रूप से, यह वैश्विक साक्ष्यों का समेकन, व्यवहारिक मॉडलों का अनुभवजन्य परीक्षण तथा उन्हें नीतिगत उपकरणों से जोड़ने का कार्य करता है। नीतिगत दृष्टि से, यह दर्शाता है कि कम लागत वाले, विस्तार योग्य सूचना-आधारित नज पारंपरिक परिवहन नीतियों के प्रभावी पूरक हो सकते हैं।

अंततः, यह शोध निष्कर्ष निकालता है कि सतत शहरी गतिशीलता की दिशा में परिवर्तन केवल तकनीकी या अवसंरचनात्मक उपायों से संभव नहीं हैं, बल्कि इसके लिए मानव व्यवहार की गहन समझ आवश्यक है। यह अध्ययन नीतिनिर्माताओं, शोधकर्ताओं और शहरी योजनाकारों के लिए एक साक्ष्य-आधारित रूपरेखा प्रदान करता है, जो सतत, निम्न-कार्बन शहरी परिवहन प्रणालियों की दिशा में संक्रमण को तेज करने में सहायक हो सकती है।

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