# MULTI-LEVEL BEHAVIOURAL, SPATIAL AND PREDICTIVE MODELLING OF NON-MOTORISED URBAN MOBILITY FOR PLANNING IN DEVELOPING CITIES

NAMAKULA HIDAYA
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## ABSTRACT

The history of human civilisation is basically the history of human mobility. Across successive eras, from early human settlements through the current digitally connected cities, human movement continually shapes economic development, social interaction and urban form. Rapid urbanisation, population growth, climate change, environmental pressures, finite urban space, digital transformation, and rising demands for social inclusion and sustainable governance are redefining urban futures. Hence, active mobility is re-emerging as an essential pathway towards resilient, sustainable and people-centred cities. However, planning for non-motorised transport in developing cities has largely evolved without an integrated understanding of the behavioural processes underlying walking and cycling. A systematic review revealed fragmented evidence dominated by cross-sectional studies from high-income countries, limited attention to behavioural-stage progression, and little evidence from rapidly urbanising African cities, exposing a critical knowledge gap for planning. This thesis addresses this gap by developing an integrated behavioural, spatial and predictive account of non-motorised urban mobility to inform planning in developing cities, using Kampala, Uganda, as the empirical setting. Six interconnected objectives guided the research: to synthesise existing knowledge; examine the socioeconomic, demographic and spatial determinants of active mobility; model pedestrian route choice; evaluate pedestrian safety through a Living Lab approach; explain the behavioural mechanisms of cycling adoption; and develop a predictive model of cycling uptake. An integrated mixed-methods design combined a systematic literature review, a cross-sectional survey of 497 Kampala residents, stated- and revealed-preference route-choice modelling, participatory crowd mapping, video-based behavioural observation, and behavioural modelling among 650 commuters using an integrated Theory of Planned Behaviour and Transtheoretical Model framework with partial least squares structural equation modelling, multigroup analysis, importance–performance analysis, and Necessary Condition Analysis. Cycling uptake was subsequently predicted using a tabular foundation model. Four overarching findings emerged. First, active mobility is fundamentally capability-led, with perceived behavioural control emerging as the dominant determinant of cycling adoption. Second, reported perceptions and observed behaviour provide complementary rather than interchangeable evidence, revealing systematic behavioural adaptation to constrained urban environments. Third, infrastructure and safety are necessary but not sufficient conditions for behavioural change, requiring complementary physical, behavioural and institutional interventions. Fourth, cycling adoption is inherently stage-dependent, with different mechanisms governing progression across behavioural stages. The tabular foundation model achieved the highest predictive performance among nine classifiers (average F1 = 0.731). The thesis concludes that effective planning for non-motorised transport requires an integrated behavioural perspective combining infrastructure provision with behavioural capability, institutional co-creation and predictive decision support. It advances a capability-led, stage-dependent theory of active mobility adoption, introduces necessity logic into behavioural transport research, establishes transferable methodological pathways for data-constrained environments, provides the first integrated behavioural evidence base for non-motorised transport in Kampala, and offers a practical framework for evidence-informed, stage-targeted planning. Although the empirical evidence is principally derived from Kampala, the analytical framework and behavioural principles provide a versatile foundation for advancing sustainable non-motorised transport planning across comparable rapidly urbanising developing cities.