

Modelling the Accessibility to On-Demand Taxi Services in Colombo, Sri Lanka

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Abstract

On-demand taxi services have rapidly become a key component of urban mobility systems worldwide, particularly in developing cities where traditional public transport often struggles to meet the demand for flexible and reliable travel options. In Sri Lanka, the introduction of app-based taxi services such as PickMe and Uber in 2015 has significantly altered urban travel behavior, especially in dense zones like the Colombo District. While these platforms offer convenience through real-time ride matching and app based booking, there is limited understanding of how accessible these services truly are across different parts of the city. This study aims to fill that gap by developing a spatial model to assess and quantify accessibility to on-demand taxi services in Colombo. Accessibility in this context refers to the ease with which users can obtain a ride, primarily determined by average waiting time and service availability. The study seeks to model the influence of socio-economic, spatial, and infrastructure-related factors on this accessibility. A quantitative modelling framework grounded in spatial analysis was adopted. The Colombo District was divided into thirteen neighborhoods to capture intra-district variation. Data was sourced from a leading on-demand taxi service provider, including waiting times, trip counts, and service coverage for each neighborhood. These data were combined with socio-economic indicators such as population density, household income, unemployment rates, household size, vehicle ownership, and transport infrastructure indicators like bus stop density and road network availability. Spatial regression analysis was carried out using R to model accessibility as a function of socio-economic and infrastructural variables. A single model was developed based on statistical fit, spatial logic, and predictive accuracy. The results show that accessibility is strongly influenced by both urban structure and socio-economic conditions. Shorter waiting times were associated with neighborhoods that had higher vehicle ownership, better road networks, and higher income levels. Conversely, areas with low density, fewer public transport connections, and higher unemployment showed poorer accessibility. Interestingly, population density was not consistently linked to better service availability, suggesting that density alone does not guarantee access if other supportive infrastructure is lacking. The model offers both predictive and diagnostic value—highlighting areas that are underserved and uncovering the key factors behind these gaps. For service providers, the insights can inform operational strategies like fleet allocation, dynamic pricing, and service expansion. For city planners, the model provides a tool to better integrate digital mobility services within broader transport planning frameworks. From a policy perspective, the findings stress the need for inclusive transport strategies that bridge digital services and spatial equity. As app based taxi platforms become embedded within urban mobility systems, ensuring equitable access will require deliberate, data-driven planning. In conclusion, this study presents a location-specific, rigorous methodology to model accessibility to on-demand taxi services. It contributes to the growing research on app-based mobility in the Global South and offers a transferable framework for analyzing accessibility in other urban environments. As cities continue adapting to digital

mobility transitions, such models are vital for fostering sustainable, inclusive, and efficient transport systems.

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