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Big Data–driven Strategies for Sustainable Urban Transportation: Integrating Dynamic Planning and Long-term Vision

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Abstract

The sustainable development of cities is a pressing global challenge, with transportation demands intensifying due to rapid urbanization. Addressing these issues requires forward-looking strategies that integrate emerging technologies into urban planning. With the proliferation of computer and network technologies, big data has become a pivotal tool for connecting spatial and temporal dimensions in urban development, enabling a shift from exclusively long-term planning to approaches that also incorporate short-term, dynamic adaptability. This study adopts a long-term perspective while leveraging real-time and dynamic urban change analysis to formulate sustainable transportation strategies. First, relevant literature is reviewed to identify sustainable transportation indicators suitable for future cities, prioritizing those derived from big data. Deep learning combined with time-series analysis is then applied to predict indicator trends. To ensure practical applicability, dynamic network processes (DNP) are used to determine the priority order of strategies under spatiotemporal changes. Based on these priorities, resource allocation is planned to develop comprehensive transportation design strategies for future cities. Drawing on advanced international practices, this research integrates innovative urban planning theories with objective analytical methods to establish a robust evaluation framework for sustainable urban development in Taiwan. Ultimately, the study aims to support informed decision-making, forecast potential operational patterns, and contribute to achieving long-term sustainability goals in urban transportation and environmental planning.

Keywords: Big Data Analytics; Deep Learning; Time-Series Forecasting; Dynamic Network Analysis; Sustainable Transportation Indicators.