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論文題目	An expert-informed audit tool for activity-friendly parks in dense urban areas		
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論文の内容の要旨

The global prevalence of physical inactivity and sedentary behaviour has become a pressing public health concern, contributing significantly to the burden of non-communicable diseases such as cardiovascular disease, type 2 diabetes, obesity, and certain types of cancer. Public open spaces are recognised as an essential component of the built environment that supports physical activity, promotes active lifestyles, and reduces risk factors for non-communicable diseases. However, rapid urbanisation in Asia has led to increasingly dense urban environments characterised by limited open space, spatial fragmentation, and intense competition for land use. Existing auditing tools have primarily been developed in low-density urban settings in the West, resulting in considerable gaps in their applicability to dense urban contexts, their cultural adaptability to Asian cities, and their usability across diverse user groups. These limitations restrict both the application and scientific evaluation of urban environments in different global contexts. This thesis addresses these challenges by developing and testing a park audit tool tailored specifically for high-density urban areas in Asia.

This research presents the development, validation, and remote adaptation of the dense urban park audit tool, with a focus on supporting park-related physical activity in dense urban settings. This study was conducted in Tokyo, Japan, a representative dense Asian city with constrained Public open space. Employing a multi-phase, mixed-methods design, the study involved: (1) the development of the dense urban park audit tool through systematic literature review and expert consensus; (2) field validation in selected urban parks; and (3) remote adaptation using publicly accessible virtual imagery.

Dense urban park audit tool was constructed through a systematic review of existing park audit tools and the construction of park environmental attributes that influence physical activity. Expert opinions were gathered through a fuzzy Delphi consultation involving interdisciplinary experts and researchers to identify and prioritise key park attributes. Dense urban park audit tool comprises six sections—park base information, park surroundings and accessibility, activity areas, facilities and amenities, aesthetics, and safety—measured via a series of quantifiable and clearly defined items. Pilot testing and iterative revisions ensured item clarity and feasibility. Field validation in 25 Tokyo parks assessed inter-rater reliability using Cohen’s kappa and percent agreement, and construct validity against a gold standard (trainer ratings). Results showed that 91.1% of items achieved kappa

values above 0.4, indicating at least moderate agreement, while 95.9% surpassed 70% agreement. Overall dimension-level validity was confirmed with 87.5% agreement, supporting audit tool's reliability and appropriateness for dense urban contexts.

Recognising the growing need for low-cost, scalable environmental assessment methods, particularly when logistical constraints limit on-site auditing across large or dispersed samples, this study introduced a remote version of dense urban park audit tool. Using Google Earth Pro as the primary data source, remote version of dense urban park audit tool was tested across 53 parks in Tokyo, with a subset (n = 25) also assessed on-site for comparative validation. Remote version of dense urban park audit tool demonstrated high inter-rater reliability, with 89% of items showing moderate to almost perfect agreement. Convergent validity, measured via intraclass correlation coefficient (ICC), indicated a strong correlation between remote and on-site assessments (ICC = 0.73). While virtual audits cannot evaluate transient or sensory attributes such as litter or graffiti, they offer significant advantages in replicability, time efficiency, and cost savings.

This thesis demonstrates a rigorous, scientifically sound and replicable research pathway for developing a park audit tool that addresses the specific challenges of dense urban environments. By bridging gaps in existing literature—inadequate applicability in dense urban contexts, insufficient adaptability to Asian cultures, and limited diversity of intended users—this research advances the scientific understanding of the link between built environment attributes and physical activity. Both on-site and remove version of dense urban park audit tool offer practical, scalable solutions for urban planners, public health professionals, and researchers aiming to enhance park environments to promote active living. In doing so, this study contributes meaningfully to the fields of urban health, built environment research, and methodological innovation.

Keywords: science-based urban design; observational audit; virtual assessment; public open space; neighbourhood design; physical activity; healthy cities

論文審査の結果の要旨

This dissertation focused on developing and validating a new park audit tool designed to evaluate activity-friendly environments in dense urban settings. The study contributed both a field-based instrument, tested across 25 parks in Tokyo, and an innovative remote version using Google Earth Pro imagery, validated across 53 parks. Together, these components demonstrate the tool's applicability in onsite and online contexts, and its potential as a practical and scientific contribution.

Examiners noted that the overall structure and presentation of the dissertation were logical and clearly articulated. One area identified for improvement was the limited explanation of how the tool specifically captures and assesses the concept of "activity-friendliness," which was a central aim of the research. Despite this, the originality of the work was emphasised, particularly in

adapting the tool for remote evaluation and applying it in high-density Asian contexts, which represents a novel direction compared with most prior tools developed in Western settings.

The research was recognised as having strong academic value, with robust findings on the reliability and appropriateness of the tool in both field and remote applications, as well as systematic identification of the limitations of each approach. The thesis has also led to publications in two peer-reviewed journals (Q1 and Q2), further demonstrating its scholarly quality and international contribution.

Overall, the dissertation was judged to demonstrate novelty, originality, and scientific merit at a high academic standard. This is an excellent dissertation and we approve awarding a doctoral degree to LUO Yufeng.