



A Sustainable and Modular Balcony Design for Data-Driven Organic Food Production in Urban Residences

Hilal Gülçin Kara¹, Aynur Kayabaş², Mehmet Norash^{3*}

¹Interior Architect, 20160, Denizli, Türkiye.

²Interior Architect, 06480, Ankara, Türkiye.

³Selçuk University, Faculty of Architecture and Design, Department of Interior Architecture, 42090, Konya, Türkiye.

Abstract

Rapid urbanization and the reduction of accessible green spaces have weakened individuals' interaction with nature, negatively affecting well-being. Balconies, as accessible micro-spaces, have the potential to support sustainable urban living but are often underutilized. This study aims to transform balconies into productive spaces through a sustainability-oriented and data-driven modular design approach. A quantitative survey was conducted with 462 participants across seven geographical regions, examining usage patterns, functional needs, and behavioral tendencies. Statistical analyses revealed significant relationships between usage frequency and functional expectations. Findings indicate strong user demand for more functional balcony use, especially for plant cultivation and psychological well-being. Based on these results, a modular design proposal integrating planting, seating, and storage was developed. The study concludes that balconies can be redefined as productive and sustainable spaces, contributing to urban living quality and design innovation.

Keywords: Balcony Design, Ecological Design, Modular Design, Organic Food Production, Sustainability, Urban Agriculture

