UNIVERSITI TEKNOLOGI MARA

LIFE CYCLE COST FRAMEWORK FOR SMART URBAN FAMING ASSOCIATED WITH LOW-INCOME COMMUNITY BEHAVIOUR IN RESIDENTIAL NEIGHBOURHOOD

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ABSTRACT

Community farming, initiated by the government, aims to address food security issues among lower-income urban populations. With technological advancements, smart urban farming (SUF) has been introduced, offering technology-driven methods that yield high productivity with minimal monitoring. It also optimizes energy and space, making it highly suitable for urban environments. However, farmers face challenges such as high initial costs, difficulty in sustaining farms due to limited financial knowledge, poor management, and dependency on external support—issues often linked to the behavioral tendencies of the B40 community. These shortcomings have created a critical gap that must be addressed. To bridge this gap, this research seeks to develop a life cycle cost framework for smart urban farming, incorporating B40 behaviors to ensure the sustainability of community farming in residential neighborhoods. Towards this end, the study sought to achieve the following objectives: (i) to identify the life cycle cost components of Smart Urban Farming associated with Smart Urban Farming practices, (ii) to determine the B40 behaviour in adopting Smart Urban Farming affecting from B40 determinant behaviour (iii) to analyse the B40's influence behaviours toward life cycle cost components of Smart Urban Farming in residential neighbourhoods and (iv) to propose the life cycle cost framework for smart urban farming concerning B40 behaviour in residential neighbourhoods.Two rounds of Delphi First Stage (semi-structured and structured interviews) were conducted with 20 experts, comprising 10 practitioners, 5 policymakers, and 5 academicians, along with a case study involving semi-structured interviews and observations, to identify SmartSUF practices. These practices were subsequently transformed into Life Cycle Cost (LCC) components. This was followed by two rounds of Delphi Second Stage (questionnaire surveys) involving 32 practitioners engaged in community farming within the B40 category. The first round of the Delphi Second Stage identified B40 determinant behaviors and their impacts on B40 behaviors, while the second round examined the influence of these determinant behaviors on LCC components. Based on these findings, a framework was developed that integrates the roles of stakeholders to sustain the longevity of community farms. The framework, abstracted from the results, was validated by four experts, including practitioners and policymakers. The study revealed 39 LCC components across five SUF life cycle phases and identified 25 B40 determinant behaviors categorized into three main factors: support, internal, and external. These behaviors were found to influence B40 attitudes toward productivity, risk, change, innovation, and the environment. Recognizing the interconnected roles of other stakeholders, the findings were divided into the responsibilities of farmers, local agencies, government, and researchers. The proposed LCC Framework for SUF provides guidance on life cycle practices, costs, and stakeholder roles, aiming to enhance operational and cost efficiency in sustaining community farming in residential neighborhoods by focusing the cost involved throughout the life cycle and stakeholder responsibilities in shaping B40 behavior, as a low-income community. The framework was validated and found applicable for industry use, and it is recommended to incorporate green infrastructure elements, such as rainwater harvesting, into community farming projects.

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TABLE OF CONTENTS

CHAPTER 1
INTRODUCTION

1.1 Introduction

Urbanization is one of the most significant global trends, presenting both opportunities and challenges as populations grow and demographics shift. In 2024, Nations (2024) reported that the global population stands at 8.2 billion and is projected to peak at approximately 10.3 billion by the mid-2080s. While a decline to 10.2 billion is anticipated toward the end of the century, there is an 80% likelihood this peak will occur within the century (Nations, 2024). This underscores the need for effective urban planning to address the challenges posed by increasing urbanization, ensuring sustainable growth and equitable access to resources (Seifollahi-Aghmiuni et al., 2022; Nations, 2024). As cities expand to accommodate this growth, they must evolve to meet the demands of housing, infrastructure, and environmental sustainability (Tadesse & Imana, 2017; Almulhim et al., 2022). In addition, Asia is experiencing rapid urbanization, with approximately one-third of the global population expected to reside in its urban areas by 2050, when the global population reaches 9.7 billion (Nations, 2024). While urbanization brings economic opportunities and improved living standards, it also exacerbates issues like inadequate infrastructure, social inequality, and environmental degradation.

Urbanization presents a range of challenges worldwide, especially in developing countries. Poor urban planning often leads to rising crime rates, health problems, and increased energy consumption, primarily due to limited access to jobs, housing, and proper waste management (Shahbaz et al., 2015; Almulhim et al., 2022). Environmental issues, including air and water pollution and increased CO_2 emissions, are further compounded by rapid urban growth (Shahbaz et al., 2016). One of the most pressing concerns is the transformation of agricultural land into urban areas. Tadesse & Imana (2017) mentioned that as cities expand, land is often lost to development, displacing farmers and disrupting local food production systems. This issue has been observed in countries like Ethiopia, China, and Pakistan, where urban sprawl has pushed farmers off their land, driving up food prices and making it increasingly difficult for populations