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Data-Driven Optimization Strategies for Resource Allocation in Small Businesses

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Small business are critical drivers of economic growth and innovation globally. However, in Sri Lanka, these businesses face significant challenges related to resource management, including inefficient allocation of labor, materials, and equipment. This study addresses these challenges by developing a data-driven approach to optimize resource allocation, focusing specifically on small-scale aqua plant businesses. Capitalizing on Sri Lanka's rich biodiversity and the growing global demand for ornamental plants, this study used an ontology-based framework with machine learning techniques to enhance operational efficiency and sustainability. The methodology employed a mixed-methods approach, combining qualitative insights from interviews with business owners, managers, and workers, alongside quantitative analysis of historical business data. An ontology was created using Protégé to categorize essential resources such as labor, materials, and equipment, and to map their interdependencies. Building on this, a machine learning model was developed in Python to dynamically adjust resource allocation based on real-time inputs, minimizing waste and reducing costs. The findings demonstrate that this integrated model significantly improves resource management practices, leading to increased efficiency and sustainability in operations. By tailoring solutions to the specific context of small-scale aqua plant businesses in Sri Lanka, this research provides actionable insights that can help SMEs overcome resource-related obstacles and thrive in competitive markets. This study highlights the practical implications of adopting data-driven optimization strategies and offers a framework that can be replicated across similar industries facing resource management challenges.

Keywords: *data-driven optimization, resource allocation, small businesses , ontology-based approach, machine learning*