# ABSTRAK

Perusahaan manufaktur di industri kemasan karton menghadapi permasalahan tata letak lantai produksi yang kurang efisien, sehingga total jarak perpindahan material mencapai 3.472,633 meter per hari. Kondisi tersebut meningkatkan waktu perpindahan material dan memengaruhi kapasitas produksi harian. Penelitian ini bertujuan merancang ulang tata letak fasilitas untuk meminimalkan jarak perpindahan material dan mengevaluasi pengaruhnya terhadap peningkatan produksi.

Optimasi tata letak dilakukan menggunakan metode *Mixed Integer Linear Programming* (MILP). Tata letak hasil optimasi kemudian dimodelkan menggunakan simulasi ProModel untuk mengevaluasi perubahan *output* produksi dan diuji secara statistik dengan *Paired Sample T-Test* pada SPSS. Selain itu, analisis feasibilitas digunakan untuk menghitung waktu pengembalian kerugian akibat relokasi fasilitas. Analisis sensitivitas juga dilakukan untuk menguji ketahanan tata letak terhadap perubahan intensitas aliran material.

Hasil penelitian menunjukkan bahwa total jarak perpindahan material berhasil diturunkan dari 3.472,633 meter menjadi 1.780,03 meter. Perbaikan tersebut meningkatkan produksi harian *Die Cut Box* dari 1.401,48 pcs menjadi 1.800 pcs dan *Carton Box* dari 2.025,37 pcs menjadi 2.540,74 pcs. Kerugian produksi selama proses relokasi dapat dipulihkan dalam waktu 8,48 hari kerja. Analisis sensitivitas menunjukkan bahwa tata letak tetap mempertahankan bentuk yang sama pada perubahan permintaan yang turun sebesar 40% hingga naik sebesar 40%.



**Kata kunci:** Tata Letak Fasilitas, *Mixed Integer Linear Programming*, *Material Handling*, Simulasi *Discrete-Event*, Analisis Sensitivitas.

**A Mixed Integer Linear Programming Approach for Production Floor Layout Improvement to Minimize Material Handling Distance**

## ABSTRACT

*The production floor layout of a make-to-order carton packaging manufacturing company was not optimally arranged, resulting in a total material handling distance of 3,472.633 meters per day. This condition increases material transportation time and affects daily production capacity. This study aims to redesign the facility layout to minimize material handling distance and evaluate its impact on improving production performance.*

*The facility layout was optimized using the Mixed Integer Linear Programming (MILP) method. The optimized layout was then simulated in ProModel to evaluate improvements in production output and validated statistically using the Paired Sample T-Test with SPSS. A feasibility analysis was also performed to estimate the payback period for production losses caused by facility relocation, while sensitivity analysis was applied to evaluate the robustness of the proposed layout under varying material flow intensities.*

*The optimization results showed that the total material handling distance decreased from 3,472.633 m to 1,780.03 m. Consequently, the daily production capacity of Die Cut Box increased from 1,401.48 pcs to 1,800 pcs, while Carton Box production increased from 2,025.37 pcs to 2,540.74 pcs. The production losses incurred during the relocation process could be fully recovered within 8.48 working days. Furthermore, the sensitivity analysis indicated that the proposed layout maintained the same configuration under demand changes ranging from a 40% decrease to a 40% increase.*

**Keywords:** *Facility Layout, Mixed Integer Linear Programming, Material Handling, Discrete-Event Simulation, Sensitivity Analysis.*