REDESIGN OF THE SUSTAINABILITY LAYOUT OF PRODUCTION FLOOR FACILITIES (CASE STUDY: PT. KUNANGO JANTAN)

FINAL PROJECT

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As One of the Requirements for Completing the Undergraduate Program at the Department of Industrial Engineering, Faculty of Engineering, Universitas Andalas

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ACKNOWLEDGEMENT

Praise and gratitude, I pray to the presence of Allah SWT for His blessings and grace so that my final project can be completed. The research proposal is entitled "**Redesign Of The Sustainability Layout Of Production Floor Facilities (Case Study: Pt. Kunango Jantan)**". This research proposal was prepared as a requirement for completing undergraduate studies in the Department of Industrial Engineering, Faculty of Engineering, Universitas Andalas. In carrying out the research proposal, the author would like to thank:

1. Mr. Ir. Insannul Kamil, M.Eng., Ph. D., IPU, ASEAN, Eng., APEC Eng., as the supervisor of the final project, who has helped, guided, and directed the author in the work on this Final Project.
2. Prof. Dr. Ir. Alizar Hasan, MSIE., M.Eng., and Ir. Taufik, M.T. As the examiner, for providing advice and recommendations for author in completing this final project.
3. Parents and family who have given support, prayers, and enthusiasm to the author in pursuing education and living life.
4. Employees of PT. Kunango Jantan has provided direction and guidance during the research.
5. Raissa Mutiara Davina S.Pt, as a partner who always accompanies and supports the author during the writing of this final project.
6. MHD. Arroyyan Fadhil S.T as senior 2nd, and Wiro Emmanuel Naibaho S.T as senior 1st who have always been a place of discussion in writing this final project.
7. TA Kontrakan, and TLFP Crew 21 who accommodated the author during the writing of this final project.
8. To the "Warga" who accompanied the author in starting to write this final project.
9. Friends of Industrial Engineering at Universitas Andalas, class of 2021, who always motivate writers in completing their final project.
10. All parties that the author cannot mention individually who have helped the author significantly in completing this final project.

The author realizes that there are still shortcomings in writing this final project report. Therefore, the author welcomes constructive criticism and suggestions for refining this final project. The author hopes that this final project report will be helpful to all parties, especially himself, in contributing to and implementing science in daily life.

Padang, July 2025

Author

ABSTRAK

Industri manufaktur di Indonesia, khususnya dalam sektor produksi tiang baja, mengalami pertumbuhan yang pesat. Namun, pertumbuhan ini membawa tantangan terkait efisiensi operasional dan dampak lingkungan. PT. Kunango Jantan, yang memproduksi tiang baja untuk sektor kelistrikan, menghadapi masalah dengan efisiensi alur material handling di lantai produksinya. Proses produksi yang melibatkan tiga tahap utama—pressing, assembly, dan coating—memerlukan manajemen alur material yang hati-hati. Jarak pemindahan material yang tidak efisien menyebabkan biaya yang tinggi, dengan pengeluaran untuk material handling mencapai Rp1,532,041.67 per siklus. Selain itu, penggunaan forklift untuk pemindahan material berkontribusi pada peningkatan emisi CO_2 akibat konsumsi energi.

Penelitian ini bertujuan untuk merancang ulang tata letak fasilitas produksi di PT. Kunango Jantan guna meningkatkan efisiensi dengan mengurangi jarak pemindahan material, menurunkan biaya operasional, dan meminimalkan dampak lingkungan. Penelitian ini menerapkan metode Systematic Layout Planning *(SLP) untuk menganalisis alur material, diikuti dengan CRAFT (*Computerized Relative Allocation of Facilities Technique*) untuk mengoptimalkan tata letak yang diusulkan. Desain ini juga mengintegrasikan prinsip keberlanjutan, dengan fokus pada pengurangan penggunaan energi dan emisi, serta mendukung keberlanjutan lingkungan. Selain itu, dampak lingkungan dihitung menggunakan perangkat lunak SIMAPRO untuk mengevaluasi emisi yang dihasilkan dari penggunaan energi dalam material handling.*

Hasil penelitian menunjukkan bahwa perancangan ulang tata letak produksi dari tata letak proses ke produk berhasil mengurangi biaya material handling sebesar Rp238.334,70 dan menurunkan emisi CO_2 sebesar 17,25% (setara dengan pengurangan 1,22 kg CO_2eq). Perubahan tata letak yang diusulkan meningkatkan efisiensi operasional sekaligus mendukung keberlanjutan lingkungan melalui penurunan konsumsi bahan bakar forklift. Sebelum perbaikan layout, konsumsi bahan bakar forklift mencapai 15,35 liter solar industri per siklus, sedangkan setelah perbaikan berkurang menjadi 12,70 liter. Berdasarkan analisis emisi gas rumah kaca (GRK), forklift diesel menghasilkan emisi sebesar 5,86 kgCO_2eq, sedangkan forklift listrik menghasilkan 23,78 kgCO_2eq. Meskipun emisi GRK forklift listrik lebih tinggi, energi yang digunakan dari sumber daya tidak terbarukan hanya 248 MJ, sementara forklift diesel mengonsumsi 556 MJ, yang mengindikasikan pengurangan abiotic depletion yang signifikan. Abiotic depletion mengacu pada penurunan sumber daya alam tak terbarukan seperti bahan bakar fosil dan mineral. Evaluasi akhir desain tata letak menunjukkan peningkatan skor sebesar 11,43%, yang mencerminkan peningkatan signifikan dalam efisiensi alur material dan pemanfaatan ruang, terutama akibat pengurangan jarak pemindahan material yang sebelumnya tidak optimal.

Kata Kunci: *Industri Manufaktur, CRAFT,* Ongkos Material Handling*, Emisi GRK,* Sustainable Layout.

ABSTRACT

The manufacturing industry in Indonesia, particularly in the steel pole production sector, has experienced rapid growth. However, this growth brings challenges related to operational efficiency and environmental impact. PT. Kunango Jantan, which manufactures steel poles for the electrical sector, faces issues with the efficiency of its material handling flow on the production floor. The production process, which involves three main stages—pressing, assembly, and coating—requires careful management of material flow. Inefficient material transfer distances result in high costs, with material handling expenses reaching Rp1,532,041.67 per cycle. Additionally, the use of forklifts for material transfer contributes to increased CO_2 emissions due to energy consumption.

This study aims to redesign the production facility layout at PT. Kunango Jantan to improve efficiency by reducing material transfer distances, lowering operational costs, and minimizing environmental impact. The research applies the Systematic Layout Planning (SLP) method to analyze the material flow, followed by CRAFT (Computerized Relative Allocation of Facilities Technique) to optimize the proposed layout. The design also integrates sustainability principles, focusing on reducing energy consumption and emissions, while supporting environmental sustainability. Furthermore, the environmental impact is calculated using SIMAPRO software to evaluate the emissions resulting from energy usage in material handling.

The research results show that the redesign of the production layout from a process layout to a product layout successfully reduced material handling costs by IDR 238,334.70 and decreased CO_2 emissions by 17.25% (equivalent to a reduction of 1.22 kg CO_2eq). The proposed layout change improved operational efficiency while supporting environmental sustainability by reducing forklift fuel consumption. Before the layout improvement, forklift fuel consumption reached 15.35 liters of industrial diesel per cycle, whereas after the improvement, it decreased to 12.70 liters. Based on greenhouse gas (GHG) emission analysis, diesel forklifts produced 5.86 kgCO_2eq, while electric forklifts produced 23.78 kgCO_2eq. Although the GHG emissions of electric forklifts are higher, the energy consumed from non-renewable resources is only 248 MJ, while diesel forklifts consume 556 MJ, indicating a significant reduction in abiotic depletion. Abiotic depletion refers to the depletion of non-renewable natural resources such as fossil fuels and minerals. The final evaluation of the layout design showed an 11.43% improvement score, reflecting a significant enhancement in material flow efficiency and space utilization, mainly due to the reduction in previously non-optimal material transfer distances.

Keywords: Manufacturing Industry, CRAFT, Material Handling Costs, GHG Emissions, Sustainable Layout