International Journal of Business and Applied Economics (IJBAE)
Vol. 4, No. 5, 2025: 2879- 2892

Redesign of Production Facility Layout Using Systematic Layout Planning (SLP) Method to Improve Operational Efficiency at PT. XYZ

Hadi Achmad[1*], Sugeng Santoso[2]
Universitas Mercu Buana
Corresponding Author: Hadi Achmad hadiach4@gmail.com

A R T I C L E I N F O

Keywords: Systematic Layout Planning, Layout of Facilities, Operational Efficiency, Material Handling, Manufacturing Industry

Received : 7, August
Revised : 22, August
Accepted: 23, September

A B S T R A C T

This study aims to redesign the layout of production facilities at PT XYZ using the Systematic Layout Planning (SLP) method to improve operational efficiency. The research method used is a descriptive quantitative approach with the analysis of material displacement distance and material displacement moment. The results showed that the alternative layout Plan A (U-Flow) was able to reduce the total transport work from 5,956.39 units to 4,118.57 units or experienced an increase in efficiency of 30.86%. These findings confirm that the SLP method is effective in improving material flow, reducing material handling costs, and improving work safety aspects. Theoretically, this study enriches the literature on the application of SLP in the manufacturing industry, while practically providing guidance on layout improvements that can increase the Company's productivity and competitiveness.

DOI: https://doi.org/10.55927/ijbae.v4i5.419
ISSN-E: 2963-6124
https://nblformosapublisher.org/index.php/ijbae

INTRODUCTION

The manufacturing industry has long been recognized as one of the key drivers of Indonesia's economic growth, contributing significantly to the national Gross Domestic Product (GDP) as well as employment creation, export performance, and technological development. According to data from the Central Bureau of Statistics (BPS), the manufacturing sector contributed IDR 877.8 trillion, or 17.84% of national GDP, in the second quarter of 2022, reaffirming its position as the backbone of the Indonesian economy. In addition, the sector accounted for 0.82% of the 5.44% year-on-year economic growth during the same period. These figures underscore the crucial role of manufacturing in sustaining economic resilience, especially amid global competition and structural transformation in domestic industries.

Despite its importance, the Indonesian manufacturing industry continues to face substantial challenges in maintaining operational efficiency. One of the most pressing issues is related to facility layout inefficiencies, which have direct implications for production performance, cost structures, and competitiveness. Inappropriate facility layouts often result in long distances of material flow, cross-movements, and backtracking, all of which increase material handling costs, prolong production lead time, and reduce overall productivity. These inefficiencies not only affect production outcomes but also hinder companies in achieving delivery targets, thereby weakening competitiveness in both domestic and international markets.

PT XYZ, a long-established company in the compressor manufacturing sector, exemplifies these challenges. The company's existing facility layout demonstrates several weaknesses, including excessive distance between workstations, misalignment between process sequences and workstation placements, and unbalanced distribution of production space. These conditions contribute to material flow inefficiencies, production delays, high operational costs, and suboptimal use of resources. With projected increases in production volume and workforce size in the coming years, these inefficiencies are expected to intensify if not properly addressed.

Addressing these challenges requires a systematic and data-driven approach to facility layout redesign. The Systematic Layout Planning (SLP) method has been widely recognized in the literature as an effective tool to optimize material flow, reduce handling costs, and improve operational efficiency. Prior studies (e.g., Adiasa et al., 2020; Putri & Juliana, 2024; Afifah & Ngatilah, 2020) demonstrate the consistent effectiveness of SLP in reducing material travel distance, eliminating cross-movements, and enhancing productivity across different manufacturing settings. However, these studies also reveal limitations, such as the lack of integration between layout redesign and time efficiency analysis, or insufficient attention to occupational health and safety (OHS) considerations.

This study builds upon the existing body of knowledge by applying the SLP method in PT XYZ with a more holistic perspective. Unlike previous research that primarily focused on material distance reduction, the present study incorporates the evaluation of material transfer time efficiency, cost-saving potential, and ergonomic aspects to ensure that the redesigned layout not only improves productivity but also creates a safer and more sustainable working environment. By doing so, the research is expected to generate theoretical contributions to the academic discourse on facility layout planning and practical implications for manufacturing companies seeking to improve competitiveness through operational excellence.

LITERATURE REVIEW

The efficiency of manufacturing operations is strongly influenced by facility layout, which determines the spatial arrangement of machines, equipment, and workstations in a production system. A well-designed layout facilitates smooth material flow, reduces production cycle time, and minimizes material handling costs, while a poorly arranged layout can result in inefficiencies, including backtracking, cross-movements, and excessive transfer distances (Goswami et al., 2020; Nurhidayat, 2021). Facility layout has thus been considered a strategic decision in operations management, as it directly affects productivity, safety, and long-term competitiveness.

Material handling is another critical factor in manufacturing efficiency. It encompasses the movement, protection, storage, and control of materials throughout the production process (Kurniawan & Pramesti, 2019). Inefficient material handling often leads to wasted time, higher operational costs, and increased risk of product damage. Principles of material handling emphasize planning, system integration, space utilization, unit load, and safety, all of which support streamlined workflows and productivity improvement. Effective material handling not only lowers costs but also contributes to operational reliability and workplace ergonomics.

Among various methods proposed to improve facility layout and material handling, Systematic Layout Planning (SLP) has emerged as one of the most widely adopted approaches. Originally developed by Richard Muther, SLP provides a structured methodology for analyzing material flow, activity relationships, space requirements, and practical constraints to generate alternative layout designs (Bagaskara et al., 2020). The SLP process consists of several steps, including analyzing product and process characteristics, evaluating activity relationships, developing space relationship diagrams, and formulating alternative layouts for evaluation. This method has proven effective in diverse industries, ranging from small-scale enterprises to large manufacturing plants, due to its systematic and flexible nature.

Numerous empirical studies have demonstrated the effectiveness of SLP in improving operational efficiency. Adiasa et al. (2020) showed that redesigning the facility layout of a plating process reduced material travel distance by more than 60%, significantly improving operational performance. Putri and Juliana (2024) applied SLP combined with the Blocplan algorithm, achieving reductions in material handling costs and travel distances. Similarly, Afifah and Ngatilah (2020) demonstrated that SLP-based redesign eliminated backtracking and cross-movement issues in a manufacturing facility, leading to shorter cycle times and higher productivity. These findings consistently highlight that SLP reduces material transfer distances, improves process flow, and lowers costs, making it a reliable tool for operational improvement.

Despite these benefits, limitations remain in the existing literature. Many studies focus primarily on quantitative outcomes, such as reductions in distance or cost, while giving limited attention to other important dimensions such as safety, ergonomics, and time efficiency. For instance, most redesigns prioritize minimizing material transfer distance but overlook the implications for operator fatigue, accident risks, or compliance with occupational health and safety (OHS) standards. As Aprilliani et al. (2022) and Jaya et al. (2021) emphasize, incorporating OHS considerations into facility layout is essential to prevent workplace accidents, improve employee well-being, and sustain long-term productivity.

This research seeks to bridge these gaps by applying the SLP method not only to minimize distance and cost but also to integrate time efficiency and OHS aspects into the layout redesign. By doing so, it extends the theoretical discourse on facility layout beyond conventional efficiency metrics and offers a more holistic approach that aligns with the broader objectives of Industry 4.0, where operational excellence, safety, and sustainability must coexist.

METHODOLOGY

This study adopts a quantitative descriptive approach by applying the Systematic Layout Planning (SLP) method to redesign the production facility layout of PT XYZ, a manufacturing company operating in the compressor industry. The choice of SLP is based on its systematic and structured procedure, which enables the evaluation of existing layouts and the design of improved alternatives through both qualitative and quantitative analysis of material flow, activity relationships, and spatial utilization.

Research Design

The research was designed to analyze inefficiencies in the current facility layout and propose an alternative that improves operational efficiency. The stages followed include:

a) Observation and data collection of existing facility layout, production processes, material flow, and space utilization.
b) Measurement of material movement distance using rectilinear (Manhattan) distance to capture actual travel patterns between workstations.
c) Calculation of material handling moments, defined as the product of distance and frequency of movement, to assess the operational load of the current layout.
d) Analysis of activity relationships using Activity Relationship Charts (ARC) and From-To Charts (FTC) to evaluate the qualitative closeness and quantitative flow intensity among facilities.
e) Development of alternative layouts through block diagrams and flow analysis, considering operational needs, space constraints, and safety requirements.
f) Evaluation and selection of the best layout alternative, based on efficiency measures such as reduction in transport work, material transfer distance, and

handling cost, as well as qualitative factors including ergonomics and occupational health and safety (OHS).

Variables

a. Independent Variable: Distance of material transfer between workstations, measured in meters.
b. Dependent Variable: Material handling moment, calculated as the product of material flow frequency and transfer distance.
c. Control Aspects: Space requirements, process sequence, and safety considerations (K3/OHS).

Data Collection

The data were obtained through:

a. Direct observation of production processes and material flows in the existing facility.
b. Company records and technical documents related to production volumes, workforce projections, and layout dimensions.
c. Interviews with production supervisors and operators to validate operational bottlenecks and safety concerns.

Data Analysis

Quantitative data were analyzed using SLP techniques, including:

a. Operation Process Charts (OPC) to describe process sequences.
b. From-To Charts to quantify flow intensity and distances.
c. Space Relationship Diagrams (SRD) to translate activity closeness into spatial allocation.
d. Transport work and efficiency calculations to compare existing and proposed layouts.

Through these procedures, the study provides a rigorous and structured analysis of the existing facility layout, enabling the development of alternative layouts that aim to minimize material handling distance, reduce operational costs, and improve both efficiency and workplace safety.

RESEARCH RESULT

Data Analysis

The layout of PT XYZ's production facilities still faces efficiency problems, characterized by long material transfer distances, irregular trajectories, and the existence of backtracking and cross-movement that increase travel time, operational costs, and decrease productivity. To overcome this, this study applies Systematic Layout Planning (SLP) which analyzes the relationship between activities, frequency of displacement, and area needs to produce a more logical and efficient layout. These improvements not only minimize distances and crossings, but also support occupational safety and health (K3) aspects through a more orderly and ergonomic material path. Quantitative analysis showed a significant decrease in material displacement moments, confirming that the new layout was able to save time, reduce costs, and increase production efficiency in a measurable way.

Table 1. Efficiency comparison

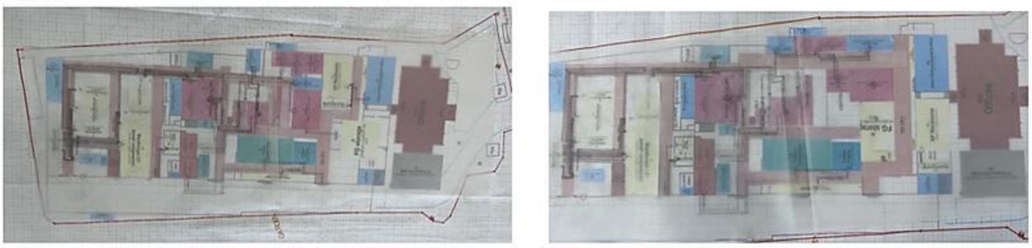
Layout	Total Transport Work	Decrease (Units)	Efficiency (%)	Flow Index	Analysis
Existing	5.956,39	–	–	–	High, lots of backtracking and cross-tracks. The relationship between activities is inefficient.
Plan A (U-Flow)	4.118,57	1.837,82	30,86%	976,64	Most efficient. High-frequency activity is brought closer together, cross-paths are minimized.
Plan B (Straight Flow)	4.621,35	1.335,04	22,42%	1.164,8	Better than existing, but the distance between high-volume activities is still too far.

Further analysis of the activity pairs with the highest displacement moments reveals crucial improvement gaps. For example, in Plan B, activity pairs 16–19 (with high frequency and 60.2 meters of distance) produced 903 transport work, the highest among all pairs. Likewise, activity 9–19, which had a material movement distance of 184.8 meters, produced transport work of 554.4, indicating the urgent need to relocate the workstation to be closer. In addition, activities 6–22 and 8–22, which accounted for 415.8 and 403.2 units, respectively, show that the position of the raw material warehouse and production input area in the Plan B layout has not been fully optimized.

By considering all aspects of quantitative efficiency, production flow effectiveness, and layout order, it can be concluded that Plan A (U-Flow) is the most feasible layout to be implemented at PT XYZ. This layout not only provides significant savings on total transport work, but also creates a more compact workflow, avoids overlapping material paths, and supports improved safety and ergonomics. In addition, Plan A's flexibility in accommodating future production capacity growth is also an important added value.

As a final result of the layout design process using the Systematic Layout Planning (SLP) approach, two alternative production layouts have been developed that aim to optimize the efficiency of material flow and the utilization of workspace at PT XYZ's facilities. The two alternatives, namely Alternative A and Alternative B, use the U-Flow principle with different strategies in the placement of warehouse areas, production centers, and quality inspection points. The evaluation is carried out based on the total flow index, the efficiency of material flow from warehouse to assembly, from receipt to warehouse, to the storage of finished goods, and land utilization. The following Figure 4.2 presents a visualization and comparison of the performance data of each of the proposed layout alternatives.

Alt. A   Alt. B



U flow, centralize of production, decentralize of the warehouse, split of the GP, fire fighting pump considered	
Total Flow Index	1763
Flow material, WH to Assembly	621.6
Flow material, Receiving to WH	762.86
Flow material, Assembly to FG	111.3
Flow material, Frame to Assembly	266.84
Land under roof	2691sq.m.

U flow, centralize of production and warehouse, move QC inspection area and split of the GP WH	
Total Flow Index	1634
Flow material, WH to Assembly	621.6
Flow material, Receiving to WH	605
Flow material, Assembly to FG	140.7
Flow material, Frame to Assembly	266,84
Land under roof	2691 sq.m.

Figure 1. New Alternative Layout

Based on Figure 1, the two layout alternatives (A and B) both use a U-shaped flow pattern, but with different configurations. Alternative A emphasizes the centralization of production areas and the decentralization of warehouses, while Alternative B brings together production and warehouse areas and moves QC to a more strategic position. In terms of efficiency, Alternative B is superior with a Total Flow Index of 1,634 compared to Alternative A of 1,763, especially in the material receipt route to the warehouse. However, Alternative A is more efficient on the final track from assembly to finished goods storage. Thus, Alternative A excels in the late stages of production, while Alternative B is more effective in the early stages of logistics. The selection of the best layout needs to be adjusted to the characteristics of the process, the intensity of the relationship between activities, and the company's long-term needs related to flexibility, supervision, and work safety.

Research Results

The main result of this study is the design of a new production facility layout with the SLP method which is proven to improve PT XYZ's operational efficiency, in the form of:

- Alternative layout Plan A (U-Flow) with transport work efficiency of 30.86%.
- Alternative Plan B (Straight Flow) layout with an efficiency of 22.42%.
- Recommendations for the implementation of Plan A as a more optimal layout.

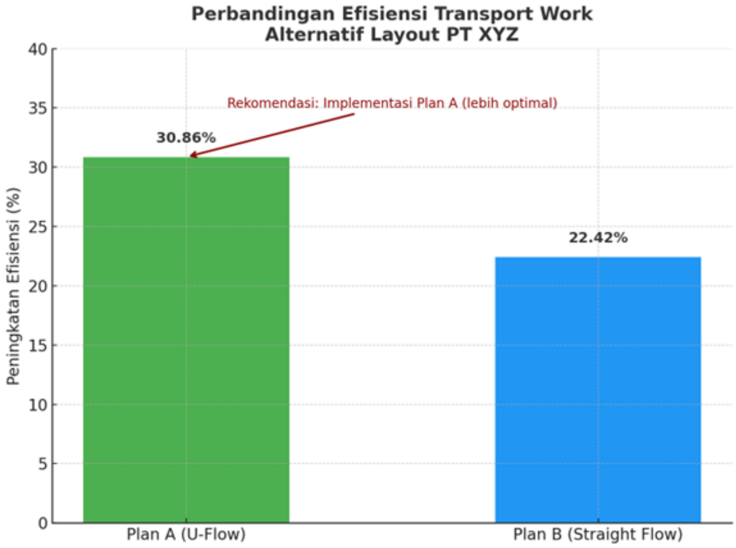


Figure 2. Comparison of Transport Work Efficiency of Alternative Layout of PT. XYZ

Thus, the solution to the problem of layout inefficiency at PT XYZ is carried out by selecting and recommending the implementation of the Plan A (U-Flow) layout, which is proven to be the most efficient and in accordance with the company's operational needs

DISCUSSION

The application of the Systematic Layout Planning (SLP) method in this study has been proven to make a significant contribution to improving the efficiency of the layout of production facilities at PT XYZ. The existing layout shows a total transport work of 5,956.39 units, which indicates a high burden of material movement due to inefficient distance between workstations and often overlapping movement flows. This condition has an impact on increasing travel time, operational costs, and potential occupational safety risks due to congested and irregular moving routes. This irregularity is reflected in the high flow index value and moment of displacement, so it is the basis for the urgency of redesigning the facility layout.

The results of the development of two alternative layouts, namely Plan A (U-Flow) and Plan B (Straight Flow), show significant improvements in system efficiency. Plan A resulted in a decrease in transport work to 4,118.57 units or 30.86% lower than the initial condition, and had a flow index of 976.64. Meanwhile, Plan B showed a transport work value of 4,621.35 units with a higher flow index, which was 1,164.8. Although both show improvements compared to the initial layout, Plan A is considered more optimal because it is able to minimize the distance of moving activities with high frequencies, shorten the material trajectory, and improve the continuity of the production process flow.

When compared to previous research, the results of this study are consistent with the findings of Bagaskara et al. (2020) which recorded a 30% reduction in material displacement distance through the SLP method. In fact, the efficiency achieved in this study exceeded the achievement of several other studies, such as Susanto & Rusindayanto (2019) which only succeeded in reducing the material displacement load by 20.93% using the combined SLP and CRAFT methods. Research by Yulia et al. (2022) focusing on daily cost efficiency through material handling reduction also strengthens the effectiveness of the SLP method, although the approach used is not comprehensive to the distance and production flow in detail as done in this study.

The novelty of this research lies in the integration of various quantitative variables in the evaluation of the layout, namely the distance of displacement, frequency of displacement, and moment of material displacement as well as comprehensive measurement of the total transport work and flow index. Not only pursuing technical efficiency, the Plan A design also considers aspects of occupational safety and health (K3), workspace regularity, and flexibility for future expansion. This approach resulted in an alternative layout that was adaptive to the complexity of the manufacturing process at PT XYZ, as well as supporting long-term operational efficiencies.

Based on the results of analysis and comparison with previous research, it can be concluded that Plan A (U-Flow) is the most feasible alternative to be implemented. Not only does it provide technical and operational efficiency, but it also harmonizes the workspace based on the logical relationship of activities. This efficiency is manifested in a significant reduction in material mileage, a decrease in transport work, as well as improvements in workflow and relationships between activities. Thus, the results of this study make a practical and academic contribution to the development of SLP-based production facility design that not only focuses on output, but also pays attention to sustainability and operational safety.

CONCLUSIONS AND RECOMMENDATIONS

This study aims to redesign the layout of the production facilities at PT XYZ using the Systematic Layout Planning (SLP) method to improve operational efficiency and improve the flow of material transfer. Based on the results of data analysis, it can be concluded that the existing layout has significant weaknesses, such as inefficient material flows, many overlapping tracks, and workstation positions that do not match the order of the production process. PT XYZ's existing layout has significant weaknesses in the form of total transport work of 5,956.39 units with a maximum displacement distance of 184.8 meters, which causes material flow inefficiency, long travel times, high material handling costs, and increased K3 risk.

Through the application of the Systematic Layout Planning (SLP) method, two alternative layouts were designed Plan A (U-Flow), Transport work efficiency increased by 30.86%, with total transport work falling to 4,118.57 units and maximum displacement distance of only 111.3 meters and Plan B (Straight Flow), Transport work efficiency increased by 22.42%, with total transport work of 4,621.35 units. Compared to the two alternatives, Plan A is more optimal because in addition to being quantitatively efficient, it also considers aspects of work safety, ergonomics, and flexibility for future production expansion.

Thus, the solution of PT XYZ's layout problems is carried out through recommendations for the implementation of Plan A (U-Flow) which has proven to be the most suitable to improve operational efficiency.

Through the application of the SLP method, two alternative layouts were successfully developed, namely Plan A (U-Flow) and Plan B (Straight Flow). Plan A showed the best performance with a decrease in total transport work to 4,118.57 units or an efficiency of 30.86% compared to the initial condition. Plan A also resulted in a lower flow index, which was 976.64, indicating a more regular and shorter flow of materials. This alternative also pays attention to the relationship between activities, spatial order, and work safety aspects, so that it is considered the most suitable to be implemented in the work environment of PT XYZ.

The results of this study provide important implications for the management of PT XYZ, namely:

1) Investment Decision Making – Management can make the results of the re-layout as the basis for strategic investment decisions in the field of production facility improvement.
2) Cost Efficiency and Productivity – The new layout reduces material handling costs by up to 30%, speeds up production process time, and increases output without the need to add more resources.
3) Occupational Safety and Health (K3) – The new layout reduces the risk of backtracking and cross-tracks, thereby reducing the potential for work accidents and supporting an ergonomic working environment.
4) Company Competitiveness – With a shorter production lead time, PT XYZ can respond to customer orders faster, improve customer satisfaction, and strengthen its position in the market.

Recommendation

Based on the results of the research and the conclusions that have been obtained, here are some suggestions addressed to related parties so that the implementation of the redesign of the layout of production facilities can run optimally and sustainably:

1. For the Management of PT XYZ
   Management is advised to immediately consider the implementation of an alternative Plan A (U-Flow) layout, as it has proven to be the most efficient in reducing material displacement burdens by more than 30%. This change in layout is also expected to improve the smooth flow of production and reduce the risk of work accidents due to overlapping material lines.
2. For Production and Quality Control (QC) Team

It is recommended that the production and QC teams conduct socialization and training on the new layout before implementation, so that all workers understand the workflow more efficiently and securely. In addition, the active involvement of the QC team is also important in ensuring that layout efficiency does not compromise product quality standards.

3. For Engineering and Maintenance Team
   The technical team is advised to carry out re-measurements and technical validation before the physical implementation of the new layout. This includes checking the electrical, ventilation system, and equipment needs at the new location to ensure the proposed layout can be implemented safely and functionally.
4. For the Department of Health and Human Welfare (Occupational Safety and Health)
   Layout changes must be accompanied by a re-evaluation of evacuation routes, assembly points, and placement of fire extinguishers. The new layout is expected to be not only efficient, but also safer and in accordance with applicable occupational safety standards.

ADVANCED RESEARCH

It is recommended to expand this research by adding variables of process time, actual cost of movement, and integration of lean manufacturing systems. Further research can also use software-based simulations such as FlexSim or AnyLogic to dynamically evaluate layout performance.

REFERENCES

Adiasa, I., Suarantalla, R., Rafi, M. S., & Hermanto, K. (2020). Perancangan Ulang Tata Letak Fasilitas Pabrik Di CV. Apindo Brother Sukses Menggunakan Metode Systematic Layout Planning (SLP). Performa: Media Ilmiah Teknik Industri, 19(2).

Anggraini, W., & Putra, R. D. E. (2017). Perancangan ulang Tata Letak Fasilitas Di Pabrik Karet P&P Bangkinang Untuk Optimalisasi Jarak Dan Ongkos Material Handling. Seminar Nasional Teknologi Informasi Komunikasi Dan Industri, 546–554.

Aprilliani, R. T. C., Fitria, D., & Samuel, L. (2022). Keselamatan dan Kesehatan Kerja (K3). Sumatera Barat: PT. Global Eksekutif Teknologi.

Bagaskara, K. B., Gozali, L., & Widodo, L. (2020). Redesign layout planning of raw material area and production area using systematic layout planning (SLP) methods (case study of CV oto boga jaya). IOP Conference Series: Materials Science and Engineering, 852(1), 012122.

Balqis, I. Z., Rusindiyanto, R., & Widjajati, E. P. (2022). Redesign of water filter using design for manufacturing and assembly to minimize cost and time. International Journal of Industrial Optimization, 3(2), 131–140.

Dresanala, M., Dewi, S. K., & Utama, D. M. (2023). Sustainable layout design based on integrated systematic layout planning and TOPSIS: a case study. Jurnal Teknik Industri, 24(1), 51–64.

Dwi, W. K., Widodo, D. S., & Supardi, S. (2022). Redesain tata letak fasilitas dengan pendekatan systematic layout planning di UD. manjur makmur. Agrointek: Jurnal Teknologi Industri Pertanian, 16(4), 499–506.

Elahi, B. (2021). Manufacturing plant layout improvement: Case study of a high-temperature heat treatment tooling manufacturer in Northeast Indiana. Procedia Manufacturing, 53, 24–31.

Elvira, L., Suhardi, B., & Astuti, R. D. (2020). Perancangan Ulang Tata Letak Fasilitas Menggunakan Metode Systematic Layout Planning Pada PT Pilar Kekar Plasindo. Tekinfo: Jurnal Ilmiah Teknik Industri Dan Informasi, 9(1), 34–46.

Esya, J. A., & Santoso, B. (2020). Redesign of the production facility layout by using systematic layout planning method at cahaya bintang mas company surabaya. Journal of Physics: Conference Series, 1569(3), 032007.

Fahmi, M. M., & Yuliana, I. (2019). Mengukur Efisiensi Kinerja Keuangan Badan Amil Zakat Nasional (Baznas): Pendekatan Metode Data Envelopment Analysis (Dea). I-Finance: A Research Journal on Islamic Finance, 5(2), 125–140.

Febri, C. A., & Susilawati, A. (2022). Productivity Improvement Based Systematic Layout Planning and 5S (Case Study: CV. Mutya, Indonesia). Journal of Ocean, Mechanical and Aerospace-Science and Engineering-, 66(1), 8–13.

Febriliano & Rosyada (2024). Perancangan Ulang Tata Letak Lantai Packing Produk ABC dengan Metode SLP (Studi Kasus: PT XYZ). Industrial Engineering Online Journal, Universitas Mercu Buana.

Febriliano, F., & Rosyada, Z. F. (2024). PERANCANGAN ULANG TATA LETAK LANTAI PACKING PRODUK ABC DENGAN METODE SYSTEMATIC LAYOUT PLANNING (STUDI KASUS: PT XYZ). Industrial Engineering Online Journal, 13(3).

Goswami, M., De, A., Habibi, M. K. K., & Daultani, Y. (2020). Examining freight performance of third-party logistics providers within the automotive industry in India: an environmental sustainability perspective. International Journal of Production Research, 58(24), 7565–7592. https://doi.org/10.1080/00207543.2020.1756504

Jaya, N. M., Dharmayanti, G., & Mesi, D. A. R. U. (2021). Manajemen Risiko K3 (Keselamatan Dan Kesehatan Kerja) Pada Proyek Pembangunan Rumah Sakit Bali Mandara. Jurnal Spektran, 9(1), 29.

Komarudin, Mamay., & Saepudin, (2021). EFISIENSI PERBANKAN SYARIAH DI INDONESIA. Jurnal Valusi: Jurnal Ilmiah Ilmu Manajemen Dan Kewirausahaan, 1(1).

Kumar, V., & Malleswari, V. N. (2022). Improvement of facility layout design using Systematic Layout planning methodology. Journal of Physics: Conference Series, 2312(1), 012089.

Kurniawan, M., & Pramesti, R. N. (2019). Analisis Penanganan Bahan (Material Handling) Produk Teh Di Pt Perkebunan Nusantara Xii Kebun Teh Wonosari Dengan Menggunakan Material Handling General Analysis Procedure. Tekmapro: Journal of Industrial Engineering and Management, 14(1), 45–52.

Kusuma, D. F., & Cahyana, A. S. (2024). SLP Method Boosts Production Efficiency by 16% in Indonesia. Indonesian Journal of Innovation Studies, 25(2), 10–21070.

Micheli, G. J. L., Rampoldi, A., & Baccanti, F. (2021). A revised systematic layout planning to fit disabled workers contexts. Sustainability, 13(12), 6850.

Mufti, D., Kholidasari, I., & Yolanda, S. D. (2023). Perbaikan Tata Letak Fasilitas dan Pola Aliran Material pada Usaha Kecil Menengah dengan Metode Triangular Flow Diagram. Jurnal Rekayasa Sistem Industri, 12(2), 201–212.

Muthia, C., & Asnawi, M. (2023). PENGARUH MATERIAL HANDLING DAN PENATAAN LAYOUT TERHADAP EFISIENSI PROSES PRODUKSI PADA PT. CHAROEN POKPHAND INDONESIA CABANG MEDAN. Journal Economic Management and Business, 2(2), 347–360.

Nurhidayat, F. (2021). Usulan perbaikan tata letak fasilitas lantai produksi dengan metode Systematic Layout Planning (SLP) di PT DSS. IKRA-ITH Teknologi Jurnal Sains Dan Teknologi, 5(1), 9–16.

Ojaghi, Y., Khademi, A., Yusof, N. M., Renani, N. G., & bin Syed Hassan, S. A. H. (2015). Production layout optimization for small and medium scale food industry. Procedia Cirp, 26, 247–251.

Pattiapon, M. L., & Maitimu, N. E. (2021). PERANCANGAN ULANG TATA LETAK FASILITAS PRODUKSI DENGAN MENGGUNAKAN METODE ALGORITMA BLOCPLAN PADA PT. X. ARIKA, 15(2), 104–114. https://doi.org/10.30598/arika.2021.15.2.104

Prasasti, G. M. Kusuma., Agusti, Febrina., & Waluyono, G. Filemon. (2023). Usulan Perancangan Tata Letak Fasilitas Bengkel Las Dengan Metode Systematic Layout Planning. Jurnal Rekayasa Proses Dan Industri Terapan, 1(3), 262–275.

Purnomo, V. P., Teppo, A. N., Husin, S., & Lahay, I. H. (2024). Perancangan Ulang Tata Letak Fasilitas dengan Metode Systematic Layout Planning Pada UMKM Olahan Tuna Fresh. Jurnal Teknik Industri, 27(1), 64–75.

Ramadhan, D., Widodo, L., Gozali, L., Sukania, I. W., Daywin, F. J., & Doaly, C. O. (2021). Redesigning the facility layout with systematic layout planning method and lean manufacturing approach on the production floor at PT. Baruna Trayindo Jaya. Proceedings of the International Conference on Industrial Engineering and Operations Management, 2596–2609.

Ridian Hadad Abiwan, & Jumaidi, L. T. (2024). Analisis Pengaruh Harga, Lokasi Usaha, Kualitas Pelayanan, Fasilitas, Lama Usaha, dan Literasi Pendidikan Masyarakat terhadap Laba Bersih Usaha Fotokopi di Wilayah Pulau Lombok. Jurnal Riset Mahasiswa Akuntansi, 4(3), 566–585. https://doi.org/10.29303/risma.v4i3.1335

Rifai, A. P., Alfithra, A. R., Al'adiat, C. F., & Sari, W. P. (2023). Facility Layout Planning for Pyrolyzer Production Using Automated Layouts Design Program (ALDEP) Method. OPSI, 16(1), 165–173.

Santoso., & Rainisa, M. Haryanto. (2020). Perancangan Tata Letak Fasilitas (Cetakan Ke-1). CV. Alfabeta.

Shafira, A., Putri, D. M., Aisha, D. L., Ghassani, S., Nurcahyo, R., & Habiburrahman, M. (2024). Redesign of Facility Layout and Material

Handling in A Cake Production Factory Using Systematic Layout Planning. In 14th International Conference on Industrial Engineering and Operations Management. https://doi.org/https://doi.org/10.46254/AN14.20240501

Suhardi, B., Juwita, E., & Astuti, R. D. (2019). Facility layout improvement in sewing department with Systematic Layout planning and ergonomics approach. Cogent Engineering, 6(1), 1597412.

Sulaiman, F., & Nanda, N. (2019). Pengendalian Persediaan Bahan Baku Dengan Menggunakan Metode Eoq Pada Ud. Adi Mabel. Jurnal Teknovasi: Jurnal Teknik Dan Inovasi Mesin Otomotif, Komputer, Industri Dan Elektronika, 2(1), 1–11.

Sumantono, T., & Santoso, S. (2022). Increased Production and Assembly Efficiency of Electronic Products with Yamazumi Diagrams and Heuristic Methods. Jurnal IPTEK, 26(2), 91–98. doi: https://doi.org/10.31284/j.iptek.2022.v26i2.2818

Susanto, F. E., & Rusindayanto, M. T. I. (2019). Analisa Perancangan Tata Letak Ulang Fasilitas Pabrik dengan Menggunakan Metode Algoritma Craft di PT. Fokus Ciptamakmur Bersama, Blitar. Prozima.

Tampubolon, J., Simangunsong, L. D. A., Sibuea, M. D. A., Sembiring, A. C., & Mardhatillah, A. (2020). Prayer paper production facility layout redesign using systematic layout planning method and CRAFT. International Journal of Science, Technology & Management, 1(4), 448–456.

Tarigan, U., & Ambarita, M. B. (2018). Production layout improvement by using line balancing and Systematic Layout Planning (SLP) at PT. XYZ. IOP Conference Series: Materials Science and Engineering, 309(1), 012116.

Tarigan, U., Ishak, A., Tarigan, U. P. P., Rizkya, I., & Mangoloi, B. (2021). Redesigning production floor layout with process layout and product layout approach in an electronic appliance manufacturing company. IOP Conference Series: Materials Science and Engineering, 1122(1), 012058.

Tuffahati, H., Mardian, S., & Suprapto, E. (2019). Pengukuran Efisiensi Asuransi Syariah Dengan Data Envelopment Analysis (DEA). JURNAL AKUNTANSI DAN KEUANGAN ISLAM, 4(1), 1–23. https://doi.org/10.35836/jakis.v4i1.27

Wicaksono, D., Setiawan, I., & Hasan, F. L. (2022). Layout Redesign to Eliminate Stagnation Using Blocplan to Increase Production Efficiency. OPSI, 15(2), 238–245.

Wignjosoebroto, S. (2009). Tata Letak Pabrik Dan Pemindahan Bahan. Guna Widya.

Yulia, A., Nurdziky, I., & Oktaria, F. (2022). Perancangan Ulang Tata Letak Fasilitas Pabrik PD Ayam Ras dengan Metode Systematic Layout Planning (SLP). J. Rekayasa Sist. Ind, 11(2), 121–128.