Tekmapro : Journal of Industrial Engineering and Management
Vol. 20, No. 2, Tahun 2025, Hal. 174-182
e-ISSN 2656-6109. URL: http://tekmapro.upnjatim.ac.id/index.php/tekmapro

# INVENTORY PLANNING ANALYSIS OF RAW MATERIALS FOR ANIMAL COSTD USING THE MRP LOT SIZING TECHNIQUE AT CV. XYZ

**Nur Rahmawati[1*)],Dean Tirkaami**

Industrial Engginering, UPN Veteran Jawa Timur, Jl. Rungkut Madya Surabaya 60294, Indonesia
e-mail: nur.rahma.ti@upnjatim.ac.id

***ABSTRACT***

*Material Requirement Planning (MRP) is a system used to organize and supervise production chain management, with the aim of managing the inventory of raw materials, components, and finished products in the manufacturing or production process. CV. XYZ has problems related to production delays caused by lack of raw material inventory. This study aims to ensure the right ordering schedule and minimize ordering costs at CV. XYZ by using the MRP method and lot sizing techniques, where the lot sizing techniques used are Least Unit Cost (LUC) and Least Total Cost (LTC). Based on the results of MRP calculations using the Least Unit Cost lot sizing technique, the total cost is Rp2,235,127 while the MRP method with Least Total Cost is Rp. 1,936,651. Thus, the MRP method with Least Total Cost has a smaller total cost than Least Unit Cost, so this is an effective solution in planning the inventory of animal Costd raw materials at CV. XYZ.*

**Keywords**:*Inventory control, Material requirement planning, Least Unit Cost, Least Total Cost.*

## A. INTRODUCTION

Companies engaged in production processes always maintain a stock of raw materials. The level of raw material inventory varies depending on the type of company. The main purposes of inventory are to eliminate the impact of uncertainty, create buffer time to manage production and purchasing, and anticipate a company's supply and demand. Inventory management plays an important role in determining inventory levels as well as implementing and monitoring decisions related to other raw material requirements to meet operational needs. Inventory must be maintained in sufficient quantity and variety to meet consumer demand, but the costs associated with holding inventory must also be taken into account. To remain stable, it is necessary to determine the types or items required in order to establish the company's minimum stock for a given period. Inventory management is a critical factor for smooth operations. Inventory control is a series of management decisions designed to determine the necessary inventory levels. Whether an order is needed to replenish stock and how much to order, inventory management ensures that the right items are available in the right quantities. The objective of management is to minimize operating costs in order to optimize company performance.

Based on this, CV. XYZ currently manages raw material inventory manually, and production has been delayed due to stock shortages caused by fluctuating demand. The pre-order system requires the company to deliver products on time, and product delivery lead time has increased from 10 to 14 days. Previously, the company had performed calculations using several methods. The Materials Requirement Planning (MRP) method is a demand-driven planning model that uses information on inventory, bills of materials, inventory status, master production schedules, and

estimated revenues to determine raw material requirements. MRP, using the lot-sizing method, is applied to calculate material requirements for final product realization. This method involves planning the needs for raw material items by determining the timing and quantity of orders required. The MRP calculation results indicate that the company needs to know the correct order schedule and the minimum ordering cost. Therefore, further calculations were carried out using the Least Unit Cost (LUC) method and the Least Total Cost (LTC) method to determine the most cost-effective option for CV. XYZ. The LUC method is used to determine lot size with the objective of minimizing ordering time based on the lowest total cost per unit. Meanwhile, the LTC method determines the optimal lot size that approaches the cumulative storage cost value but does not exceed the ordering cost.

## B. LITERATURE

### 1. Inventory Planning

Planning involves not only selecting organizational goals through policies and programs, but also defining tasks and timelines for their implementation. It encourages managers at all levels of the organization to plan their work with the goal of achieving specific results. Plans are tools used to achieve specific goals, so managers at every level need to plan their work, ensuring they are reasonable, clear, and understandable, and prepared for potential changes. In the context of production planning, developing an effective production plan is crucial, although this process is complex due to the various factors that influence it. The plan serves as the foundation for subsequent steps.With proper planning, a business can survive any economic fluctuation. Planning is also essential for estimating raw material needs, determining the quantity needed to acquire raw materials, and carrying out administrative tasks related to raw material procurement. Plans can be divided into three types: strategic, short-term, and long-term. Accounting is a crucial management function because it involves the largest investment in local currency. Some experts emphasize the importance of accounting as a tool for managing changing situations and conditions. Control refers to the act of monitoring or controlling changes, parameters, situations, or conditions. This includes ensuring that ongoing activities are consistent with the company's objectives and structural plans. Inventory management applies across all sectors to encourage sales and maximize the use of products and resources. Raw materials inventory is the raw material used in production activities, obtained directly from nature or from suppliers who produce the products used by the manufacturing company. Merchandise is part of the final product whose costs can be clearly traced [3]. Inventory planning is a strategic process in supply chain management that involves determining the quantity of materials or products needed, when to order them, and how much to store to meet production or customer demand. This strategy balances two main cost components: ordering costs and holding costs, with the goal of minimizing total inventory costs [17]. Modern inventory planning not only considers deterministic demand but also manages demand uncertainty, service levels, and yield uncertainty. The application of stochastic optimization and robust optimization methods allows companies to maintain stock availability without burdening excessive holding costs [16].

### *2. Change Over Strategy*

Changing inventory systems can be implemented for various reasons, such as improving efficiency, reducing costs, or better controlling inventory levels. Change in inventory is the difference between the inventory amount in the last reporting period

and the inventory amount in the current reporting period. This concept is used as a starting point for calculating cost of goods sold and for evaluating inventory management effectiveness in the materials management department. This concept is also used in preparing the necessary budgets [2]. *Change Over Strategy* is a strategy related to the time and cost of changing between products or batches in the production process. This strategy is very important in planning inventory because it affects production frequency and batch size. Higher setup/change-over time or costs encourage the selection of larger lot sizes to reduce changeover frequency, but this also increases storage costs [13]. The application of the Single Minute Exchange of Dies (SMED) principle in changeover can significantly reduce machine downtime, increase flexibility, and maintain optimal production capacity. Holgado et al. (2022) added that reducing production losses during changeover can be achieved through the separation of internal-external activities, standardization of procedures, and operator training [15].

3. *Lot Size*

Lot size is the quantity obtained from order entry and order release in the MRP program. Lot size is a way to determine the size of an order, but lot size refers to the quantity purchased from a supplier. There are several ways to determine lot size. The lot size methods used in this study are least unit cost and least total cost [1]. Lot sizing is a dynamic lot sizing technique that aims to minimize the total inventory costs—including ordering costs and holding costs—by selecting a lot size where both are nearly balanced [12]. Determining the appropriate lot size must take into account demand uncertainty, production capacity, and even hybrid uncertainties factors that include stochastic and fuzzy variability. In a Material Requirements Planning (MRP) system, lot sizing is used to convert material requirements plans into efficient purchasing or production plans [18].

4. *Lot For Lot*

Lot for Lot (LFL) is also called the least-numbered method. Based on the idea of simply holding (or hoarding) stock, inventory levels are kept to a minimum. This process carries risks, especially if there are delays in delivery. If the inventory consists of raw materials, it will lead to static production. If the inventory consists of finished goods, it will result in an inability to meet customer demand. This method reduces carrying costs and is often used for expensive products. The advantage of lot for lot (LFL) is that there is no inventory and therefore no overhead costs. The disadvantage is that if an unexpected error occurs and demand exceeds expected, the company will have difficulty meeting that demand because the company will not have inventory [5]. This is the simplest and easiest to understand lot sizing technique. Orders are placed with the goal of minimizing holding costs. In this technique, net inventory requirements (Rt) are met in each period where they are needed, while the order quantity (lot size) is equal to the net inventory requirements for that period. This technique is typically used for expensive items or those with high levels of continuous demand [8]. Lot For Lot is a method where order quantities are precisely matched to actual needs each period—aka ordering "as needed." This strategy aims to minimize storage costs because there is no stockpiling, but the frequency of orders becomes high, so ordering costs can increase. In the event of late deliveries, this approach risks delaying the production process [9].

*5.* Least Unit Cost (LUC) Method

Least Unit Cost (LUC) is the amount added as the product price decreases over time. The product price is determined by the order size and batch administration costs. In the event of a tie, a minimum payment is made. Material costing techniques are used to determine the quantity that will reduce the time required for delivery based on the total cost per unit to achieve the target price. This method takes the smallest unit cost in a given period. This method results in a higher price per unit of time. This method is used because it allows for more efficient planning by determining how much and what type of purchasing activity is required, thus allowing purchases to be made at the right time and in the right quantity [5]. A method for determining the lot size of an order is based on the lot that provides the minimum unit cost [6]. Least Unit Cost is a dynamic lot-sizing technique that determines the lot size based on the lowest cost per unit. It does this by calculating the total ordering and holding costs for each candidate lot size, then dividing the total cost by the number of units in the lot to obtain the cost per unit. The lot that produces the lowest unit cost is selected. This method often uses a trial-and-error approach, considering whether the order should cover only the current period's needs or should be extended to the next period's needs [10].

*6. Least Total Cost Method*

The LTC method determines the order lot size by finding a lot size that balances holding costs and the asking price. The calculation process using the LTC method starts from the first period and requests additional periods to determine the maximum possible lot size. If calculating the aggregate holding cost after the demand aggregation process, the aggregate holding cost will approximate the ordering cost. The optimal lot size is one that provides a holding cost close to the ordering price but not exceeding it. Take advantage of this opportunity if it wasn't covered in previous work [7]. LTC is a dynamic lot sizing technique that aims to minimize the total inventory costs—including ordering and holding costs—by selecting a lot size where the two are nearly balanced. This concept is very similar to the classic EOQ model, but is applied in a discrete context and within a specific planning horizon. LTC uses the term Economic Part-Period (EPP)—the amount of inventory that, if held for a period, will result in holding costs equal to ordering costs—as a guide to selecting the optimal lot size [11].

## C. RESEARCH METHOD

### 3.1 *Flowchart*

Below is a flowchart or steps to solve the problem at CV. XYZ where the method that will be used to solve this problem is MRP (Material Requirement Planning) with the existing method in Lot Sizing, namely Leasta Unit Cost and Least Total Cost.

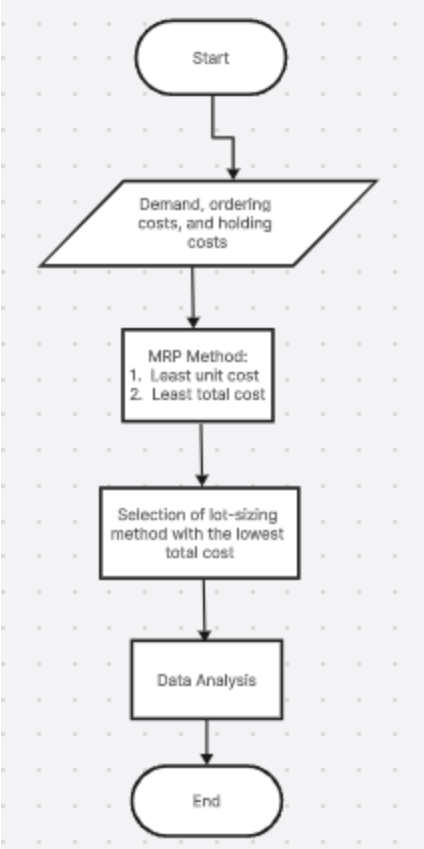


**Figure 1.** Flowchart

The following is an explanation of the steps in problem-solving based on the flowchart above:

1. Starting

Starting is the initial stage in conducting research.

2. Data Collection

Information for this study is obtained from secondary data sources. Three types of data are used: product demand data, ordering cost data, and holding cost data.

3. Data Processing

After the data collection stage, the data is processed. The collected data will be processed using the MRP (Materials Requirement Planning) method with the Least Unit Cost and Least

4. Selecting lot sizing method with lowest total cost

In this section, the selection of the lot-sizing method in MRP is carried out based on the lowest total cost.

5. Results and Discussion

After validation, the results are discussed. The results and discussion in this study must be consistent with the literature review and theoretical framework.

6. Conclusion

The conclusion stage contains a brief, clear, and systematic summary of the problem, the results obtained, and suggestions for future research.

### 3.2 *Conceptual Framework*

The conceptual framework becomes a bridge that connects theory or concepts

with research, providing direction for designing structured and directed research. This conceptual framework is a logical and systematic thinking approach so that research concepts can be explained more easily. Below is the conceptual framework for this research:

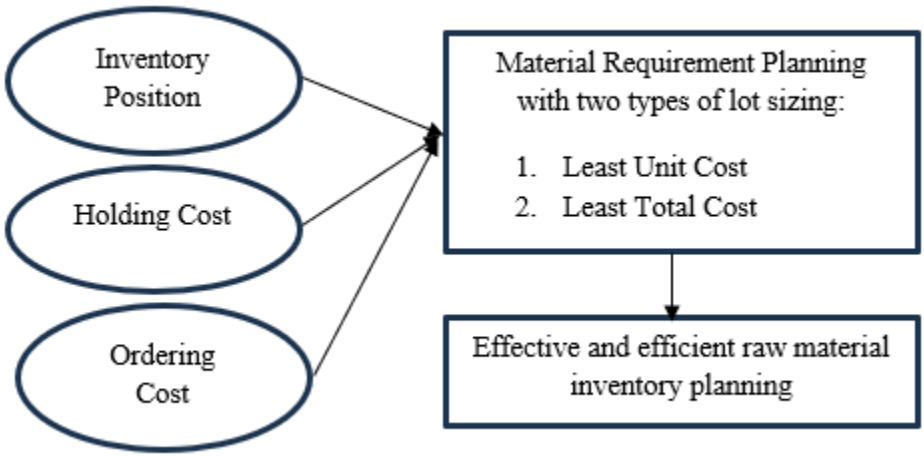


**Figure 2.** Conceptual Framework

### 3.3 *Data Collection*

Data on demand for animal Costd products obtained through secondary data at CV. XYZ can be seen in the collected data in the table below:

*Table I*

*Product Demand Data*

| No | Period (2021) | Demand |
|---|---|---|
| 1. | January | 17100 |
| 2. | February | 19500 |
| 3. | March | 19500 |
| 4. | April | 17500 |
| 5. | May | 20000 |
| 6. | June | 18000 |
| 7. | July | 19700 |
| 8. | Agust | 16000 |
| 9. | September | 18100 |

| | | |
|---|---|---|
| 10. | October | 18100 |
| 11. | November | 20100 |
| 12. | December | 17900 |

## D. RESULT AND DISCUSSION

### D.1. Least Unit Cost

The LUC method allows raw material requirements to be calculated by determining the optimal order quantity for each raw material. The overall MRP and total material cost calculations using the LUC method are shown in the table below:

*Table II*
*MRP with LUC method*

| MRP Animal Costd | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Master Production Schedule* | | | | | | | | | | | | |
| Bulan | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| MT | | 398 | 448 | 418 | 412 | 432 | 429 | 410 | 413 | 444 | 416 | 411 | 418 |
| | *Lead Time* | *Safety Stock* | *Lot Sizing* | | | | | | | | | | |
| | 1 | 31 | LUC | | | | | | | | | | |
| | *Overdue* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| *Gross Requirement* | | 398 | 448 | 418 | 412 | 432 | 429 | 410 | 413 | 444 | 416 | 411 | 418 |
| *Shedule Receipt* | | | | | | | | | | | | | |
| *Project On Hand* | 35 | 534 | 983 | 565 | 1028 | 596 | 1037 | 627 | 1102 | 658 | 1100 | 1138 | 720 |
| *Net Requirement* | | 0 | -55 | -534 | -122 | -565 | -136 | -596 | -183 | -627 | -211 | -658 | -689 |
| *Planned Order Receipt* | | 897 | 897 | | 875 | | 870 | | 888 | | 858 | | 449 |
| *Planned Order Release* | | 897 | 0 | 875 | 0 | 870 | 0 | 888 | 0 | 858 | 449 | 0 | 0 |

| Lot Size | Cost | |
|---|---|---|
| LUC | Total Ordering Cost | Rp230.000 |
| | Total Holding | Rp382.503 |
| | Total | Rp612.503 |

| Raw material | Cost Type | |
|---|---|---|
| | Ordering | Holding |
| Animal Cost | Rp46.000 | Rp38 |

Information:
Total POH = 263550
Cost Costs = 3 x Rp 292.000 = Rp 876,000
Storage Costs = 263550 x Rp 5.157 = Rp1.359.127
Total Costs = Rp 876.000 + Rp 1.359.127 = Rp 2.235.127

### D.2. Least Total Cost

The LTC method allows raw material requirements to be calculated after the optimal order quantity for each material is known. While the LTC calculation is similar to the LUC calculation, the final calculation has several differences. The complete MRP calculation using the LTC method and the total material cost are shown in the table below:

*Table III*
*MRP with LTC method*

| MRP Pakan Ternak | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Master Production Schedule* | | | | | | | | | | | | | |
| Bulan | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| MT | | 398 | 448 | 418 | 412 | 432 | 429 | 410 | 413 | 444 | 416 | 411 | 418 |
| | *Lead Time* | *Safety Stock* | *Lot Sizing* | | | | | | | | | | |
| | 1 | 0 | LTC | | | | | | | | | | |
| | *Overdue* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| *Gross Requirement* | | 398 | 448 | 418 | 412 | 432 | 429 | 410 | 413 | 444 | 416 | 411 | 418 |
| *Shedule Receipt* | | | | | | | | | | | | | |
| *Project On Hand* | 35 | 534 | 86 | -332 | 529 | 97 | -332 | 525 | 112 | -332 | 497 | 86 | -332 |
| *Net Requirement* | | 363 | 0 | 0 | 1238 | 0 | 0 | 742 | -112 | 332 | 748 | -86 | 332 |
| *Planned Order Receipt* | | 897 | 0 | 0 | 1273 | | 0 | 1267 | | 0 | 1245 | 0 | |
| *Planned Order Release* | | 0 | 0 | 1273 | 0 | 0 | 1267 | 0 | 0 | 1245 | 0 | 0 | 0 |

| Lot Size | Cost | |
|---|---|---|
| LTC | Total Ordering Cost | Rp184.000 |
| | Total Holding | Rp43.149 |
| | Total | Rp227.149 |

| Raw material | Cost Type | |
|---|---|---|
| | Ordering Cost | Holding |
| Animal Costd | Rp46.000 | Rp38 |

Table 4.2 Calculation *Least Total Cost*

Information :
Total POH = 149050
Cost Costs = 4 x Rp 292.000 = Rp 1.168.000
Storage Costs = 149050 x Rp5.157 = Rp 768.651
Total Costs = Rp1.168.000 + Rp 768.651 = Rp 1.936.651

## D.3. Comparative Analysis

From the calculations above, below are the results of the comparison of the MRP method using the LUC and LTC lot sizing techniques:

*Table IV*
*Cost Comparison*

| Costs | MRP Method With Lot Size | |
|---|---|---|
| | LUC | LTC |
| Cost Costs | Rp 876.000 | Rp 1.168.000 |
| Storage Costs | Rp 1.359.127 | Rp 768.651 |
| Total | Rp 2.235.127 | Rp 1.936.651 |

A comparison table analysis of the MRP method and the lot sizing technique, focusing on minimum values, shows that the Least Total Cost method produces the most optimal total

inventory cost of Rp. 1,936,651. In this case, CV. Happy Bulu can choose the LTC lot sizing method as a strategic solution in planning raw material inventory for animal Costd products. Based on the MRP calculation results, the total storage cost using the LTC method is lower than the LUC method because the LTC method has the fewest storage periods. Fewer storage periods result in lower storage costs.

## E. CONCLUSION

The conclusion that can be drawn is based on the results that have the minimum value is the result of the MRP calculation with the lot sizing method, with Least Unit Cost producing a total cost of Rp2,235,127 while the MRP method with Least Total Cost Rp. 1,936,651 Thus the MRP method with Least Total Cost has a small total cost compared to Least Unit Cost. Minimizing the number of raw material orders is a solution to planning the inventory of raw materials for animal Costd at CV. XYZ. Thus CV. XYZ can plan raw material orders at the most optimal price so that it can increase customer satisfaction by maintaining the availability of adequate raw materials for animal Costd. The suggestion proposed for further research is to add other Lot Sizing Techniques so that it can choose the most optimal lot size technique.

## Bibliography

[1] Isnantoro, M. R., & Hariastuti, N. L. P. (2023). Analisa Penggunaan Lot Sizing dalam Perencanaan Persediaan Bahan Baku dengan Menggunakan Metode Material Requirement Planning di Pt. Xyz. Prosiding Seminar Nasional Teknologi Industri Berkelanjutan III, 3(Senastitan Iii).

[2] Kumar, P., Gupta, M. M., Yadav, D., & Kumar, V. (2024). Benefits of preservation technology, reworking, and waste management in sustainable production-inventory system in inflationary environment. FRONTIERS IN INDUSTRIAL AND APPLIED MATHEMATICS: FIAM2022, 3081(1), 080002. https://doi.org/10.1063/5.0196349

[3] Mevia, I. P. A., & Purnomo, H. (2023). Analisis Perencanaan Dan Pengendalian Persediaan Bahan Baku Terhadap Proses Produksi Di Ras Design Interior. Simposium Manajemen dan Bisnis II, 2(1), 1617–1629.

[4] https://proceeding.unpkediri.ac.id/index.php/simanis/article/view/3387

[5] Pratama, E. P. J., Mawadati, A., & Susetyo, J. (2023). Usulan Perbaikan Perencanaan Persediaan Bahan Pakan Konsentrat Hewan Ternak Sapi Menggunakan Metode Lot for Lot (Lfl) Least Unit Cost (Luc) Dan Least Total Cost (Ltc) Pada Ud. Sadewa Farm. Jurnal REKAVASI, 11(1), 66–73.

[6] Sari, L. A., & Achmad Fauzi. (2023). Analisa Efisiensi Biaya Persediaan Headset Electric Yc D-2018 Menggunakan Metode Deterministik Dinamis Pada Pt Aerofood Indonesia Unit Ists. Jurnal Akuntansi dan Manajemen Bisnis, 3(1), 95–103. https://doi.org/10.56127/jaman.v3i1.665

[7] Subekti, & Yevita Nursyanti. (2023). Optimasi Persediaan Dengan Pendekatan Deterministik Dinamis Pada Industri Manufaktur. Jurnal Teknologi dan Manajemen Industri Terapan, 2(I), 8–18. https://doi.org/10.55826/tmit.v2ii.83

[8] L. Gozali, Andres, and R. Handika, “Usulan Penentuan Teknik Lot Sizing Terbaik dengan

Minimisasi Biaya dalam Perencanaan dan Pengendalian Kebutuhan Canvas EP 200 Conveyor Belt di PT. XWZ," *Jurnal Kajian Teknologi*, vol. 9, no. 2, pp. 132–144, Jul. 2013.

[9] S. M. Javadi, S. J. Sadjadi, E. Teimoury, dan A. Makui, "Material requirements planning with a novel lot sizing method and a new algorithm for production scheduling," Scientific Reports, vol. 15, p. 27637, Jul. 2025, doi: 10.1038/s41598-025-13197-8.

[10] A. Segerstedt, B. Abdul-Jalbar, dan B. Samuelsson, "Reformulated Silver-Meal and Similar Lot Sizing Techniques," Axioms, vol. 12, no. 7, p. 661, 2023, doi: 10.3390/axioms12070661.

[11] R. Kian, E. Berk, Ü. Gürler, H. Rezazadeh, dan B. Yazdani, "The effect of economies-of-scale on the performance of lot-sizing heuristics in rolling horizon basis," International Journal of Production Research, published online Feb. 26, 2020, doi: 10.1080/00207543.2020.1730464.

[12] B. Zhu, Y. Zhang, K. Ding, F. T. S. Chan, J. Hui, dan F. Zhang, "Lot-sizing decisions for material requirements planning with hybrid uncertainties in a smart factory," Advanced Engineering Informatics, vol. 51, p. 101527, 2022, doi: 10.1016/j.aei.2022.101527.

[13] M. H. Jabeur et al., "Optimizing integrated lot sizing and production scheduling in flexible flow line systems with energy scheme: A two-level approach based on reinforcement learning," Computers & Industrial Engineering, 2024, doi: 10.1016/j.cie.2024.110095.

[14] S. Thevenin, Y. Adulyasak, dan J.-F. Cordeau, "Material Requirements Planning Under Demand Uncertainty Using Stochastic Optimization," Production and Operations Management, vol. 30, no. 2, pp. 475–493, 2021, doi: 10.1111/poms.13277.

[15] P. Renna, "Switch-Off Policy in Flow Lines with Dynamic Fractional Task Assignation," Sustainability, vol. 17, no. 9, Art. no. 4096, 2025, doi: 10.3390/su17094096.

[16] S. Thevenin, Y. Adulyasak, and J.-F. Cordeau, "Material Requirements Planning Under Demand Uncertainty Using Stochastic Optimization," Production and Operations Management, vol. 30, no. 2, pp. 475–493, 2021, doi: 10.1111/poms.13277.

[17] G. Garcia-Garcia, Y. Singh, and S. Jagtap, "Optimising Changeover through Lean-Manufacturing Principles: A Case Study in a Food Factory," Sustainability, vol. 14, no. 14, Art. no. 8279, 2022, doi: 10.3390/su14148279.

[18] B. Zhu, Y. Zhang, K. Ding, F. T. S. Chan, J. Hui, and F. Zhang, "Lot-Sizing Decisions for Material Requirements Planning with Hybrid Uncertainties in a Smart Factory," Advanced Engineering Informatics, vol. 51, Art. no. 101527, 2022, doi: 10.1016/j.aei.2022.101527.