The Application of Safety Stock in Controlling Packing Entry (PE) Inventory

Nova Juliana Puspitasari, Aries Kurniawan*, Putra Panji Respati, Tsabita Khwarazmita, Beni Dwi Komara

Entrepreneurship Study Program, Faculty of Economics and Business, Universitas Muhammadiyah Gresik, Indonesia
Corresponding author. Email: ariesaja@umg.ac.id

ABSTRACT
Inventory management of Packing Entry (PE) at PT Gemah Ripah Lohjinawi Industri is challenged by demand variability and uncertainty in procurement lead time, which may result in stockouts that disrupt production activities or overstock conditions that increase inventory holding costs. Therefore, an effective and systematic inventory control approach is required to mitigate these risks. This study aims to determine the optimal level of safety stock and the appropriate reorder point (ROP) by employing a simulation-based approach using historical data. A quantitative method with a probabilistic model is applied, incorporating a 95% service level ($Z = 1.645$) to account for demand and lead time variability. The empirical data indicate an average daily demand of 75 units with a standard deviation of 21.79 units, and an average lead time of 3.67 days with a standard deviation of 0.75 days. The findings reveal that the optimal safety stock level is 115 units, while the reorder point is established at 390 units. These results demonstrate that the implementation of a probabilistic inventory control model enables a transition from a reactive to a proactive decision-making approach, thereby enhancing operational reliability and systematically reducing the likelihood of stockouts and overstock conditions.

Keywords: *safety stock, reorder point, inventory control, demand variability, lead time uncertainty*

1. INTRODUCTION

Inventory represents a critical component in the operational management system of manufacturing companies, as it is directly associated with production continuity and cost efficiency. The availability of materials in the right quantity and at the right time is essential to ensure smooth production processes. However, in practice, inventory management is frequently confronted with dynamic uncertainties, both in terms of demand and supply (Mohamed, 2023).

Such uncertainties give rise to two primary risks, namely stockouts and overstock conditions. Stockouts may lead to production disruptions and reduced service levels, whereas overstock increases holding costs and the risk of excessive inventory accumulation (Hasan et al., 2025; Edison, 2025). Therefore, an effective inventory control system is required to systematically and quantitatively anticipate these uncertainties (Febriana et al., 2025).

PT Gemah Ripah Lohjinawi Industri is a manufacturing company whose operations heavily depend on the availability of Packing Entry (PE) as a supporting material in the production process. Based on field observations, the current inventory management of PE is still conducted using conventional and reactive approaches, where replenishment decisions are made only after stock shortages occur. Furthermore, demand fluctuations and lead time uncertainty from suppliers have not yet been addressed through a structured quantitative approach (Acar et al., 2010).

Previous studies have demonstrated that the implementation of safety stock and reorder point methods can improve the effectiveness of inventory control and reduce the risk of stockouts (Edison, 2025; Ridwan & Ahsan, 2024) . However, some studies still rely on simplified approaches that do not simultaneously consider demand variability and lead time uncertainty . Therefore, this study adopts a more comprehensive probabilistic approach.

Based on the above considerations, this study aims to analyze demand and lead time variability, determine the optimal level of safety stock, and establish the appropriate reorder point (ROP) as a basis for inventory control of Packing Entry (PE) at PT Gemah Ripah Lohjinawi Industri.

2. RESEARCH METHODS

This study employs a descriptive quantitative approach using a simulation method to analyze the inventory control of Packing Entry (PE) at PT Gemah Ripah Lohjinawi Industri. This approach is selected as the study focuses on processing numerical data, specifically demand and lead time, to determine measurable safety stock levels and Reorder Points (ROP) (Saldanha et al., 2023).

The data used in this study are simulated data constructed to reflect realistic operational conditions of the company, consisting of 12 periods of monthly demand and 12 observations of procurement lead time from suppliers. The monthly demand data are subsequently converted into daily units by assuming 25 working days per month, ensuring consistency with the lead time unit expressed in days.

Data analysis is conducted through several stages, including the calculation of the mean and standard deviation of daily demand, the mean and standard deviation of lead time, and the determination of a 95% service level corresponding to a Z-value of 1.645. Furthermore, safety stock is calculated using a probabilistic model that simultaneously accounts for demand variability and lead time uncertainty. Subsequently, the Reorder Point (ROP) is determined as the basis for replenishment decision-making. The standard deviation is calculated manually to ensure transparency and accuracy in the data analysis process.

3. RESULTS AND DISCUSSIONS

3.1 Demand Data

Table 1. Packing Entry (PE) Demand Data

Period	Monthly	Daily
Jan	1700	68
Feb	1800	72
Mar	1750	70
Apr	1900	76
Mei	1800	72
Jun	1850	74
Jul	2000	80
Agust	1950	78
Sep	1800	72
Okt	1950	78
Nov	1900	76
Des	2100	84
Rata-rata	1875	75

3.2 Calculation of Demand Standard Deviation

Table 2. Demand Standard Deviation

Period	Xi	$(Xi-\bar{X})$	$(Xi-\bar{X})^2$
Jan	1700	-175	30625
Feb	1800	-75	5625
Mar	1750	-125	15625
Apr	1900	25	625
Mei	1800	-75	5625
Jun	1850	-25	625
Jul	2000	125	15625
Agust	1950	75	5625
Sep	1800	-75	5625
Okt	1950	75	5625
Nov	1900	25	625
Des	2100	225	50625
Jumlah	22500	-	142500

$$\sigma = \frac{\sqrt{142500}}{12} \approx 108{,}97$$

$$\sigma daily \approx 21{,}79$$

3.3 Lead Time Data

Table 3. Lead Time Standard Deviation

No	Li	(Li−L̄)	(Li−L̄)²
1	3	-0,67	0,4489
2	4	0,33	0,1089
3	3	-0,67	0,4489
4	5	1,33	1,7689
5	3	-0,67	0,4489
6	4	0,33	0,1089
7	3	-0,67	0,4489
8	4	0,33	0,1089
9	5	1,33	1,7689
10	3	-0,67	0,4489
11	4	0,33	0,1089
12	3	-0,67	0,4489
Total	44	-	6,6668

$$\sigma L = 0{,}75$$

3.4 Safety Stock Calculation and Reorder Point Calculation

$$S = Z \times \sqrt{\bar{L} \times \sigma d^2 + \bar{d}^2 \times \sigma L^2}$$

$$ROP = (\bar{d} \times \bar{L}) + SS$$
$$ROP = 390\ unit$$

3.5 Analysis of Variability

Table 4. Contribution of Variability

Source	Score	Percentage
Demand	1742,53	35,5%
Lead Time	3164,06	64,5%

3.6 Discussion

The results of this study indicate that the primary issue in managing PE inventory at PT Gemah Ripah Lohjinawi Industri lies in the system’s inability to simultaneously anticipate demand uncertainty and lead time variability. This condition leads the company to adopt a reactive approach in making procurement decisions (Kurniawan et al., 2022).

The implementation of safety stock at a level of 115 units has proven to function as an effective buffer in addressing such fluctuations. Theoretically, safety stock is used to protect inventory systems from uncertainties in demand and procurement lead time (Heizer et al., 2020). With the presence of this reserve, the company is able to maintain production continuity despite sudden increases in demand or delays in delivery.

Furthermore, the analysis reveals that lead time variability contributes more significantly, accounting for 64.5%, compared to demand variability at 35.5%. This finding indicates that the primary source of uncertainty originates from the supplier side. This result is consistent with previous studies which state that lead time uncertainty has a significant impact on safety stock requirements (Ridwan & Ahsan, 2024).

In addition, the implementation of a Reorder Point (ROP) of 390 units provides a clear basis for determining the appropriate timing for replenishment. With the establishment of ROP, the company no longer waits until inventory is depleted, but instead performs proactive ordering based on a predetermined threshold (Davis, 2016).

Overall, the findings of this study demonstrate that a probabilistic approach to inventory control is not only theoretically relevant but also practically effective. The application of safety stock and ROP is able to enhance operational stability while reducing the risks of stockout and overstock (Edison et al., 2025).

REFERENCES

Acar, Y. et al. (2010) "A decision support framework for global supply chain modelling: an assessment of the impact of demand, supply and lead-time uncertainties on performance," *International Journal of Production Research*, 48(11), hal. 3245–3268.

Davis, R. A. (2016) *Demand-driven inventory optimization and replenishment: Creating a more efficient supply chain*. John Wiley & Sons.

EDISON, C. (2025) "COMPANY OF NEW YORK," *INC., Ravenswood Nuclear Generating Unit A." Preliminary Hazards Summary Report" and" Site Data", prepared in co-operation with Westinghouse Electric Corporation and Stone and Webster Engineering Corporation (no date given)*.

Febriana, D. S. *et al.* (2025) "Enhancing Operational Performance through Social Media Optimization and Effective Inventory Control Using the Reorder Point Method at Swakarja Coffee and Space."

Hasan, M. et al. (2025) "Exploring the role of entrepreneurship education on digital entrepreneurship interest among generation Z students: the power of digital growth mindset in a mental model perspective," *Entrepreneurship Education*, 8(2), hal. 235–253.

Heizer, J. et al. (2020) "Operations management: Sustainability and supply chain management."

Kurniawan, A. *et al.* (2022) "The Importance of Improving the Ability of '' Guanxi '' towards the Implementation of School Business Centers." doi: 10.4108/eai.2-8-2023.2341273.

Mohamed, O. A. M. (2023) "How generative AI transforming supply chain operations and efficiency?"

Ridwan, A. F. dan Ahsan, M. (2024) "Penentuan Reorder Point dan Safety Stock pada Consumable Material Berdasarkan Peramalan Menggunakan Artificial Neural Network," *Jurnal Rekayasa Industri (JRI)*, 6(1), hal. 51–61.

Saldanha, J. P. et al. (2023) "A nonparametric approach for setting safety stock levels," *Production and operations management*, 32(4), hal. 1150–1168.