

Analysis of Medicine Delays for Acute Respiratory Infections in Hospitals in the Jakarta Regional

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ABSTRACT

This study examines the causes of delays in providing medication to Acute Respiratory Infection (ARI) patients in hospitals within the Jakarta region and develops strategies to address this issue. The research findings, based on the Analytic Hierarchy Process (AHP) method reveal that empty stock at the distributors have the most significant impact on medication distribution delays, followed by wrong branch selection. The SWOT analysis results show that the Empty Stock at the Distributor is in quadrant III position which requires minimizing weaknesses to seize opportunities. Meanwhile, the alternative of wrong branch selection is in quadrant I which requires utilizing strengths to seize opportunities. It can be concluded that this indicates the company must utilize strengths to reduce weaknesses and seize opportunities. Strategies to enhance the efficiency of pharmaceutical distribution is using an integrated stock monitoring system and use of real-time stock monitoring system and strategically collaborating with distributors. The system helps companies manage stock more effectively, efficiently, and organized, while increasing competitiveness in the market. Collaboration with distributors become a key step to speed up the distribution process, reduce the risk of shortages or overstocks, and improve customer satisfaction through more timely and efficient deliverie. This research contributes theoretically to the integration AHP-SWOT approach focused on optimizing supply chain management can suggest strategy improving hospital procurement processes, and reducing ISPA medication distribution delays to enhance service level agreement which is necessary to enhance the quality of medical services in Jakarta.

Keywords: Analytic Hierarchy Process (AHP), SWOT, Supply Chain Management, Risk Management, Medicine Delays.

Introduction

Acute Respiratory Infections (ARI) represent a significant public health challenge in Indonesia, including Jakarta. This illness is typically caused by viral or bacterial infections, with symptoms ranging from mild coughs to potentially fatal pneumonia[1]. According to

data from the Indonesian Ministry of Health, ARI ranks highly among the most frequently occurring diseases, particularly affecting children and the elderly. Given the high prevalence of ARI, prompt and effective treatment is essential to prevent serious complications and fatalities[2].

Recent data from the Ministry of Health reveals a significant surge in ARI cases[3]. In 2023, cases reached approximately 200,000 nationwide, with increases influenced by air pollution and prolonged dry seasons. In the Jakarta area alone, from January to June 2023, 638,291 ARI cases were recorded[4]. This data indicates that ARI remains a serious health threat in urban areas, especially for vulnerable groups such as children and the elderly[4].

Medication distribution delays in hospitals, particularly for managing ARI, pose a critical issue in healthcare services. Such delays can impact the effectiveness of treatment and create risks to patient safety[5]. Ensuring the timely availability of medications is crucial in ARI treatment. Factors contributing to these delays include supply chain obstacles, stock shortages, and slow administrative processes[6].

Methods

The research framework is depicted in Figure 1 as follows.

Consequently, examining the causes of medication distribution delays for ARI in Jakarta’s hospitals is essential to prevent adverse patient effects.

This study aims to identify the factors that cause delays in medication provision for ARI patients in Jakarta hospitals. By uncovering the main causes of these delays, effective solutions can be proposed to improve distribution efficiency and enhance healthcare service quality.

The procurement of medications for ARI is a crucial aspect of healthcare services that requires serious attention from all related parties[7]. Given Indonesia’s rising number of ARI cases, particularly in Jakarta, ensuring a smoothly operating, efficient, and effective medication procurement system is vital[8].

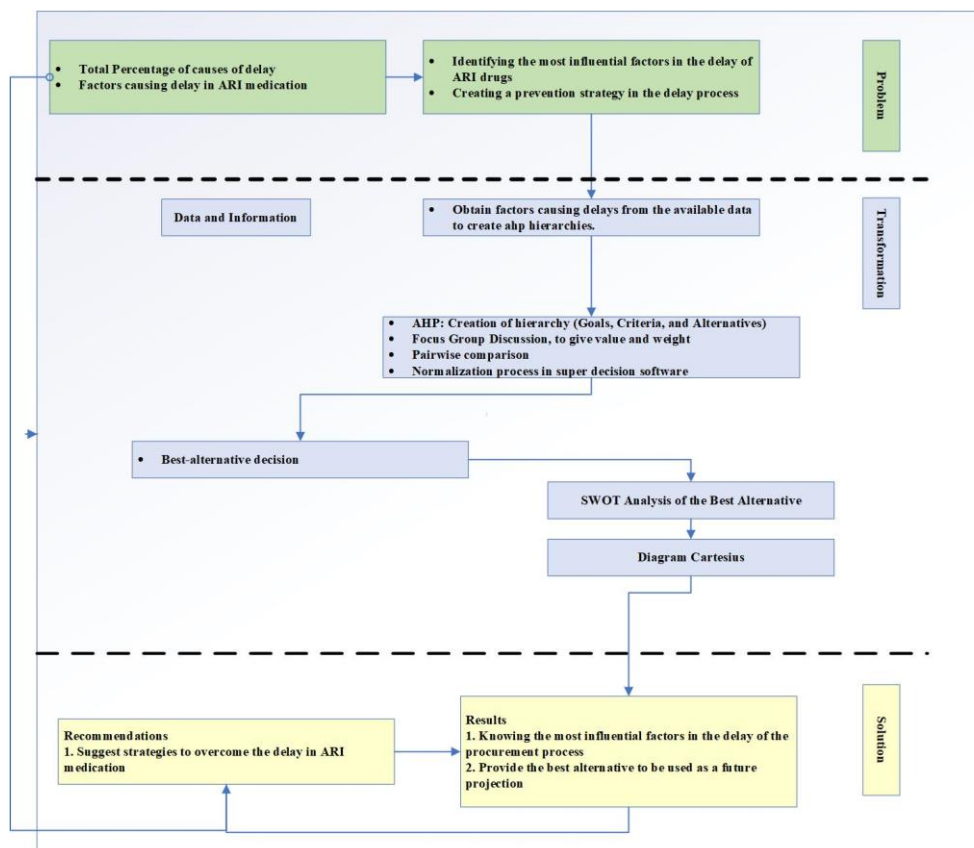


Figure 1. Framework Thinking

The primary objective of this study is to formulate preventive strategies to address delays in ARI medication procurement using the AHP and SWOT methods. The Analytic Hierarchy Process (AHP) is a powerful

approach for finding the best options in decision-making processes involving various criteria[9]. This method breaks down complex problems into a hierarchical structure, allowing for a more systematic evaluation of

alternatives[10]. In AHP, alternatives are compared individually, considering specific criteria such as cost, quality, and time. The outcome of this process is a priority weight for each criterion, which is then used to calculate the final score for each alternative[11]. AHP's strength lies in its ability to accommodate users' subjective preferences and deliver accurate results[12]. SWOT analysis (Strengths, Weaknesses, Opportunities, Threats) is a strategic planning method used to identify a company's strengths, weaknesses, opportunities, and threats[13]. This analysis enables a company to better understand itself and its environment, allowing it to design the most effective strategies. These four elements form the primary foundation for determining the company's strategic direction[14]. Internal strengths, such as workforce and physical assets, and internal weaknesses, like resource limitations, are evaluated along with external opportunities, market growth, and external threats, such as regulatory changes[15]. Therefore, SWOT analysis helps a company strengthen its competitiveness, seize new opportunities, and avoid significant risks[16]. This strategy focuses on ARI medication

provision to reduce Service Level Agreement (SLA) violations exceeding three days and provides solutions for the most influential factors in ARI medication procurement delays, offering the best alternative projections for the future[17].

Results and Discussions

AHP Hierarchy

In the Analytic Hierarchy Process (AHP) method, the decision-making process begins with a conceptual approach involving creating a hierarchical structure[18]. The main focus of this hierarchy is to reduce delays in ARI medication procurement. This diagram is divided into several interrelated main components, starting with significant aspects such as Stock Issues, Ordering and Purchasing Processes, Providers, and Administration[19]. At the next level, the diagram further details each main factor into various, more specific strategies or approaches. Figure 2 illustrates a decision network that hospital pharmacy managers and distributors must analyze to reduce ARI medication delays.

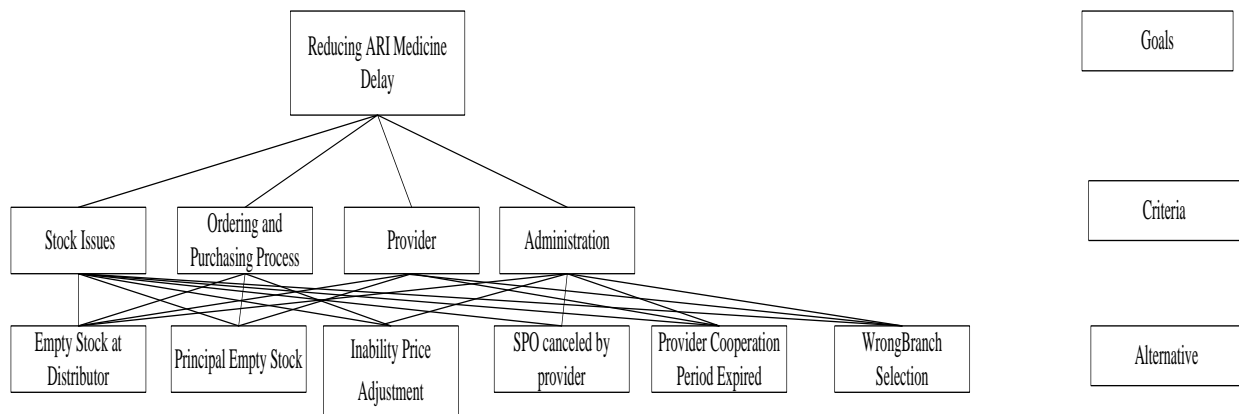


Figure 2. AHP Hierarchy

Pairwise Comparison of Criteria Based on Goals

To establish the priority of criteria for the main objective, namely "Reducing ARI Medication Delays," a pairwise comparison matrix is used. The pairwise comparison matrix plays a crucial role in supporting the decision-making process by directly comparing elements. As part of the Analytic Hierarchy Process (AHP) method, this approach enables a systematic evaluation of alternatives based on specific criteria[20]. By utilizing Saaty's scale, each element is compared with the others to determine weights that reflect their importance level[21]. The strength of this matrix lies in its ability to reduce subjectivity in decision-making and build consensus among stakeholders. Additionally, this matrix simplifies the determination of clear and measurable priorities, particularly in complex situations[22]. This matrix compares the four criteria in pairs to determine a priority order based on their respective importance[23]. For instance, it may be determined that "Stock Issues" are more critical than "Ordering and Purchasing Processes," "Provider," and "Administration." Consequently, the priority order of criteria becomes "Stock Issues," followed by "Ordering and Purchasing Processes," "Provider," and "Administration." Saaty's scale, applied in AHP for pairwise element comparison, assigns values as follows: 1 for equal importance, 2, 4, 6, and 8 as intermediate values, 3 for slightly more important, 5 for more important, 7 for very important, and 9 for absolutely more critical [24]. Table 1 presents a summary of the pairwise comparison matrix for these criteria.

Table 1. Comparison in pairs between criteria

Sub Indicators	Administration	Stock Issues	Ordering and Purchasing Process	Providers
Administration	1	0.3	0.3	2
Stock Issues	3	1	3	3
Ordering and Purchasing Process	3	0.3	1	3.0
Providers	0.5	0.3	0.3	1

Stock Issues is considered slightly more important than Administration, therefore stock issues are given a value of 3 and administration is given a scale value of 1, so that the value of the pairwise comparison coefficient between administration and stock issues is 1/3 or 0.3 This value is also given to the comparison of administration and the Ordering and Purchasing Process. while the provider is given a value of 2 more dominant than the administration. The pairwise comparison matrix is also carried out on each paired sub-indicator in the same way.

Pairwise Comparison of Alternatives Based on Criteria

The pairwise comparison matrix between criteria and alternatives is a tool that simplifies the selection of the most suitable alternative based on the established criteria. This matrix uses a comparison Saaty scale [25]to assess the relative importance of each criterion concerning the available alternatives. Although straightforward, this tool effectively supports more accurate and efficient decision-making. Table 2 presents the pairwise comparison matrix between the criteria and the alternatives.

Table 2. Comparison Administration Against the Alternatives

Sub Indicators	Inability Price Adjustment	Provider Cooperation Period Expired	Wrong Branch Selection	The provider cancelled SPO	Empty Stock at the Distributor	Principal Empty Stock
Inability Price Adjustment	1	2	0.25	2	0.25	2
Provider Cooperation Period Expired	0.5	1	2	2	0.25	2
Wrong Branch Selection	4	0.5	1	2	0.25	2
The provider cancelled SPO	0.5	0.5	0.5	1	0.25	2
Empty Stock at the Distributor	4	4	4	4	1	7
Principal Empty Stock	0.5	0.5	0.5	0.5	0.14	1

Inability Price Adjustment is considered slightly more important than the Provider Cooperation Period Expired, therefore the Provider Cooperation Period Expired is given a value of 1 and the Inability Price Adjustment is given a scale value of 2. so that the value of the pairwise comparison coefficient between the Provider Cooperation Period Expired and the

Inability Price Adjustment is 2. This score is also given to the comparison of Inability Price Adjustment and wrong branch selection. while the provider canceled SPO is given a value of 2 more dominant than Inability Price Adjustment. The pairwise comparison matrix is also carried out on each paired sub-indicator in the same way.

Table 3. Comparison of Stock Issues Against Alternatives

Sub Indicators	Inability Price Adjustm ent	Provider Cooperation Period Expired	Wrong Branch Selection	The provider canceled SPO	Empty Stock at the Distributor	Principal Empty Stock
Inability Price Adjustment	1	3.0	0.3	3.0	0.3	3.0
Provider Cooperation Period Expired	0.3	1	0.3	3.0	0.3	2.0
Wrong Branch Selection	3.0	3.0	1	5.0	0.3	3.0
Provider canceled SPO	0.3	0.3	0.2	1	0.3	0.3
Empty Stock at the Distributor	3.0	3.0	3.0	3.0	1	3.0
Principal Empty Stock	0.3	0.5	0.3	3.0	0.3	1

Table 4. Comparison of Ordering and Purchasing Processes Against the Alternatives

Sub Indicators	Inability Price Adjustm ent	Provider Cooperatio n Period Expired	Wrong Branch Selection	The provider canceled SPO	Empty Stock at the Distributor	Principal Empty Stock
Inability Price Adjustment	1	2	0.3	2	0.3	2
Provider Cooperation Period Expired	0.5	1	0.3	0.3	0.3	2
Wrong Branch Selection	3	3	1	3	0.3	3
The provider canceled SPO	0.5	3	0.3	1	0.3	3
Empty Stock at the Distributor	3	3	3	3	1	3
Principal Empty Stock	0.5	0.5	0.3	0.3	0.3	1

Table 5. Comparison of Providers Against Alternatives

Sub Indicators	Inability Price Adjustm ent	Provider Cooperatio n Period Expired	Wrong Branch Selection	SPO was canceled by the provide r	Empty Stock at the Distributor	Principal Empty Stock
Inability Price Adjustment	1	0.3	0.3	2	0.3	2
Provider Cooperation Period Expired	3	1	0.3	2	0.3	2
Wrong Branch Selection	3	3	1	2	0.3	2
The provider canceled SPO	0.5	0.5	0.5	1	0.3	2
Empty Stock at the Distributor	3	3	3	3	1	3
Principal Empty Stock	0.5	0.5	0.5	0.5	0.3	1

Weighting Results Using Super Decisions Software

After completing the matrix calculations, the researchers input data from the focus group discussion (FGD) into the Super Decisions software. Super Decisions is a software application that supports complex decision-making processes by applying the Analytic Hierarchy Process (AHP) and Analytic Network Process (ANP)[26]. The process begins by constructing a hierarchical model with objectives, criteria, and alternatives. Users rate each element through pairwise comparisons, which are

then processed to generate priority weights. Super Decisions also enables sensitivity analysis of decision outcomes, allowing users to understand the impact of changes in criteria or alternatives. This tool strongly supports selecting the best alternative based on the established criteria, such as reducing delays in ARI medication procurement. The results include two types of comparisons: pairwise comparisons between criteria and pairwise comparisons between alternatives. In Figure 3, a graph shows the relationship between objectives and criteria by normalized value from super decision software

results. The results also shows that inconsistency value below 0.1. The Stock Issues holding the highest

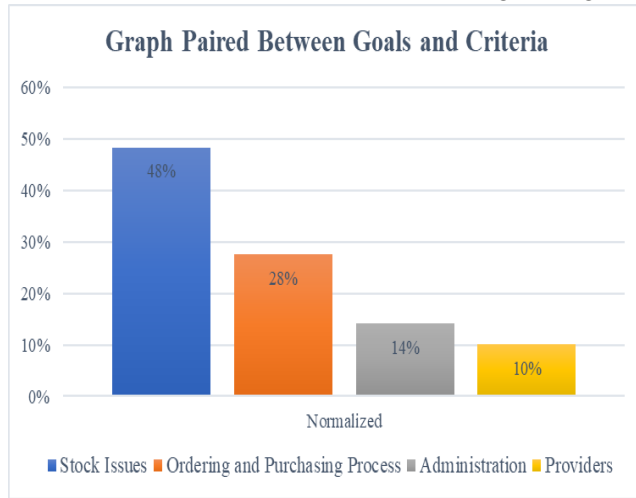


Figure 3. Graph Paired Between Goals and Criteria

In Figure 3, the comparison graph between criteria and alternatives shows that the highest priority alternative is Empty Stock at the Distributor of 36%, this value is obtained from average normalized value all alternative pairwise comparison. All alternative pairwise comparison also shows that inconsistency value below 0.1. In contrast, the lowest priority alternative is Principal Empty Stock, with a total weight of 7%.

SWOT Analysis

Based on the normalization results, two main alternatives can be chosen: Empty Stock at the Distributor and Wrong Branch Selection. Both strategies share the same goal of reducing delays in ARI medication distribution. The next step is to conduct a SWOT analysis to determine the weights of each strength, weakness, opportunity, and threat, allowing their comparisons and benefits to be assessed [27] at Table 6 and 7.

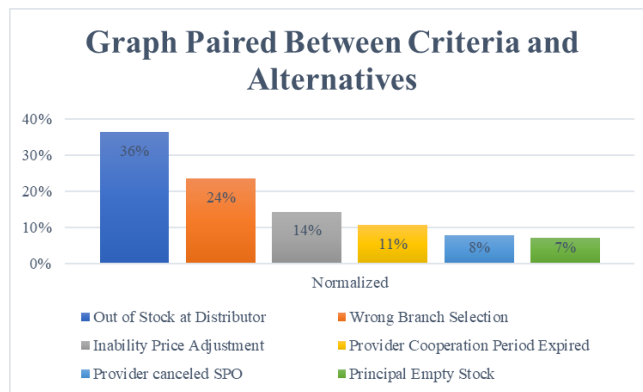


Figure 4. Graph Paired Between Criteria and Alternatives

Table 6. SWOT Analysis on the Alternative of Empty Stock at the Distributor

Category	Factor	Urgency	Category	Factor	Urgency
Strengths	S1: More Distribution Fast to Branch	4	Weaknesses	W1: Dependence on Distributors	3
	S2: Large Capacity	2		W2 : Limited Control of Distributor Stock Management	4
	S3: Accessibility Stock Information	3		W3 : Potential Incompatibility Product	2
Opportunities	O1: Partnership Long Term with Distributor	2	Threats	T1: Competition with Other Parties to Get Stock	4
	O2:Implementation System Integrated Stock Monitoring	4		T2 :Fluctuations Unfulfilled Requests Suspected	3
	O3:Diversification Distributor Network	3		T3: Delays Delivery from Principal to Distributor	2

Table 7. SWOT Analysis on the Alternative of Wrong Branch Selection

Category	Factor	Urgency	Category	Factor	Urgency
Strengths	S1: Speed up Delivery Drug to the Right Branch	4	Weaknesses	W1: Dependence on the System Management Proper Distribution	4
	S2: Improve Efficiency Chain Supply	2		W2: Potential Data Error or Slow Information	3
	S3: Minimize Risk of Stock Piling Up in Unattended Branches Need	3		W3: Involvement Factor Man	2
Opportunities	O1: Implementation Technology Automation	2	Threats	T1 : Complexity Chain Supply	4
	O2: Improvement Training Employee	3		T2 : Risks Finance from Cost Delivery Repeat	2
	O3: Usage System <i>Real-Time</i> Stock Monitoring	4		T3: Branch Dissatisfaction and Decline Trust	3

The SWOT Analysis Table for the Alternative of Empty Stock at the Distributor and Wrong Branch Selection above explains several factor that have urgency (by scale 1-5) for considering to next step in SWOT analysis in determining weight to get score from each factor on category. Understanding the strengths, weaknesses, opportunities, and threats associated with this model health organizations in

making more accurate decisions to reduce ARI medication distribution delays. The next step is giving rate for each category on a scale from 1 to 5. The final score of each category presented in Table 8 and 9, displaying the weights and scores of the SWOT Analysis for the alternative of empty stock at the Distributor and wrong Branch Selection.

Table 8. Weighting and Scoring of SWOT Analysis on the Empty Stock Alternative at the Distributor

Category	Factor	Urgency	Weight	Ratings	Score	Category	Factor	Urgency	Weight	Ratings	Score
Strengths	S1 : Quicker Distribution to Branches	4	0.22	5	1.11	Weaknesses	W1:Dependence on Distributors	3	0.17	4	0.67
	S2 : Large Capacity	2	0.11	2	0.22		W2:Limited Control over Distributor Stock Management	4	0.22	5	1.11
	S3:Accessibility Stock Information	3	0.17	3	0.50		W3: Potential Incompatibility Product	2	0.11	2	0.22
Opportunities	O1:Partnership Long Term with Distributor	2	0.11	2	0.22	Threats	T1:Competition with Other Parties to Get Stock	4	0.22	5	1.11
	O2:Implementation of Integrated Stock Monitoring System	4	0.22	4	0.89		T2:Fluctuations Unfulfilled Requests Suspected	3	0.17	4	0.67
	O3:Diversification Distributor Network	3	0.17	5	0.83		T3:Delays Delivery from Principal to Distributor	2	0.11	3	0.33

Table 9. Weighting and Scoring of SWOT Analysis on Wrong Alternative of Branch Selection.

Category	Factor	Urgency	Weight	Ratings	Score	Category	Factor	Urgency	Weight	Ratings	Score
Strengths	S1: Accelerate Drug Delivery to the Right Branch	4	0.22	5	1.11	Weaknesses	W1 : Reliance on Proper Distribution Management System	4	0.22	5	1.11
	S2: Improve Efficiency Chain Supply	2	0.11	2	0.22		W2: Potential Data Error or Slow Information	3	0.17	3	0.50
	S3: Minimize Risk of Stock Piling Up in Unattended Branches Need	3	0.17	4	0.67		W3: Involvement Factor Man	2	0.11	2	0.22
Opportunities	O1: Implementation Technology Automation	2	0.11	2	0.22	Threats	T1: Complexity Chain Supply	4	0.22	5	1.11
	O2 : Improvement Training Employee	3	0.17	4	0.67		T2 : Risks Finance from Cost Delivery Repeat	2	0.11	2	0.22
	O3: Use of Real-Time Stock Monitoring System	4	0.22	5	1.11		T3: Branch Dissatisfaction and Decline Trust	3	0.17	4	0.67

After performing the calculations shown in Table 8 and 9 and consulting with experts, the researchers conducted an analysis of the internal (S-W) and external factor (O-T) scores listed in these tables. The results of this positional analysis can be found in Tables 10 through 17.

Table 10. Analysis of Strength Positions on Empty Stock at Distributors.

No	Factor	Urgency	Weight	Ratings	Score
1	Strengths 1	4	0.22	5	1.11
2	Strengths 2	2	0.11	2	0.22
3	Strengths 3	3	0.17	3	0.50
Amount	1.83				

Table 11. Analysis of Weakness Positions of Empty Stock at Distributors.

No	Factor	Urgency	Weight	Ratings	Score
1	Weakness 1	3	0.17	4	0.67
2	Weakness 2	4	0.22	5	1.11
3	Weakness 3	2	0.11	2	0.22
Amount	2.00				

Based on the calculations in the tables above, a subtraction was performed from 1.83-2.00, resulting position of -0.17 . Next, the scores for external factors were calculated and can be seen in Table 12 and 13.

Table 12. Analysis of Opportunities Positions of Empty Stock at Distributors.

No	Factor	Urgency	Weight	Ratings	Score
1	Opportunities 1	2	0.11	3	0.33
2	Opportunities 2	4	0.22	4	0.89
3	Opportunities 3	3	0.17	5	0.83
Amount	2.06				

Table 13. Analysis of Threats Positions of Empty Stock at Distributors.

No	Factor	Urgency	Weight	Ratings	Score
1	Threats 1	4	0.22	5	1.11
2	Threats 2	3	0.17	4	0.67
3	Threats 3	2	0.11	2	0.22
Amount	2.00				

Table 12 and 13 shows Total Opportunities score is 2.06 and Total Threats score is 2.00, resulting position of 0.06. Following this, the positional analysis related to branch selection was calculated, as shown in Table 14 through 17.

Table 14. Analysis of Strengths Positions for Wrong Branch Selection

No	Factor	Urgency	Weight	Ratings	Score
1	Strengths 1	4	0.22	5	1.11
3	Strengths 3	2	0.11	2	0.22
4	Strengths 4	3	0.17	4	0.67
Amount	2.00				

Table 15. Analysis of Weakness Positions for Wrong Branch Selection

No	Factor	Urgency	Weight	Ratings	Score
1	Weakness 1	4	0.22	5	1.11
2	Weakness 3	3	0.17	3	0.50
3	Weakness 4	2	0.11	2	0.22
Amount		1.83			

Table 16. Analysis of Opportunities Positions for Wrong Branch Selection

No	Factor	Urgency	Weight	Ratings	Score
1	Opportunities 1	2	0.11	2	0.22
2	Opportunities 2	3	0.17	4	0.67
3	Opportunities 3	4	0.22	5	1.11
Amount		2.00			

Table 17. Analysis of Threats Positions for Wrong Branch Selection

No	Factor	Urgency	Weight	Ratings	Score
1	Threats 1	4	0.22	4	0.89
2	Threats 2	2	0.11	2	0.22
3	Threats 3	3	0.17	3	0.50
Amount		1.61			

Table 14 and 15 indicate that the total strength score is 2.00, while the total weakness score is 1.83. The difference between these values is 0.17, representing the position on the X-axis as internal factors. In Table 16 and 17, the total score for opportunities is 2.00, while the total score for threats is 1.61. The difference between these values is 0.39, representing the position on the Y-axis as external factors.

Based on the positional analysis of the alternatives in the tables above, a Cartesian diagram can be created, with the details shown in the diagram below.

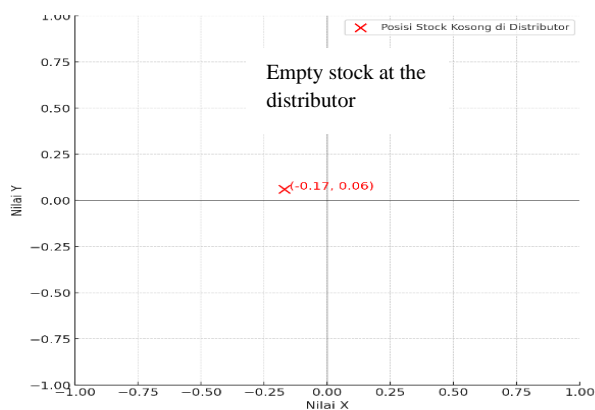


Figure 5. Cartesian diagram of SWOT analysis on the alternative of Empty Stock at the Distributor

Based on Table 10 through 13, the Cartesian diagram shows the analysis of position the Stock Shortage at the Distributor, $X = -0.17$ and $Y = 0.06$. This point is located in quadrant III (negative X, positive Y), indicating an area with more weaknesses than strengths, though there is a small opportunity for improvement. The proposed strategy focuses on utilizing existing strengths to seize opportunities for improvement. Based on this approach, concrete and practical steps are developed that aim to optimize these strengths to overcome various weaknesses, so that opportunities for improvement can be maximized effectively.

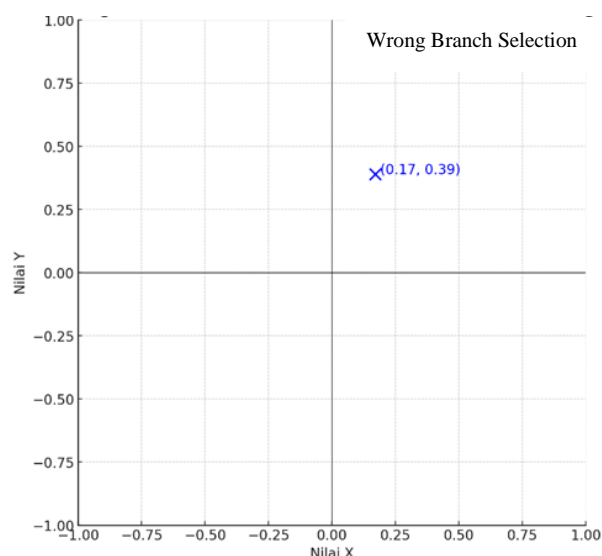


Figure 6. Cartesian Diagram SWOT Analysis on the Alternative of Wrong Branch Selection

In Figure 6, the analysis shows the position of Wrong Branch Selection, $X = 0.17$ and $Y = 0.39$ (quadrant I) indicating that although there are weaknesses to address, this position also has significant strengths and opportunities for improvement. Positioned positively in terms of strengths and opportunities, the strategy can be focused on maximizing this potential to reduce delays in the distribution of respiratory disease (ISPA) medication.

Alternative of Empty Stock at the Distributor is in quadrant III position which requires minimizing weaknesses to seize opportunities. Meanwhile, the alternative of wrong branch selection is in quadrant I which requires utilizing strengths to seize opportunities. It can be concluded that this indicates that the company must utilize strengths to reduce weaknesses and seize opportunities.

Based on the highest score in factor of each category SWOT that is explained on Table 8 and 9, Strengths: Quicker Distribution to Branches and Accelerate medicines Delivery to the Right Branch. Weaknesses: Limited Control over Distributor Stock Management and Reliance on Proper Distribution Management System.

The strategy is carried out by utilizing opportunity factors, namely Implementation of Integrated Stock Monitoring System and Use of Real-Time Stock Monitoring System provides a range of key benefits, such as improving operational efficiency, preventing shortages or overstocking, and supporting fast and accurate decision-making. The system also strengthens integration between departments, reduces human error, improves customer service, saves costs, and maintains data security. Overall, the system helps companies manage stock more effectively, efficiently, and organized, while improving competitiveness in the market [28]. Moreover, strategically collaborating with distributors effective to ensure operational efficiency, enhance competitiveness, and achieve business objectives in a sustainable manner. According to Porter [29], strategic collaboration involving reliable distribution partners can create a more competitive value chain, allowing companies to focus more on their core advantages. This is in line with the views of Christopher [30], who emphasizes that close integration with distribution partners enables more efficient supply chain management, thereby providing added value to consumers while supporting sustainable business growth.

Conclusions

The Analytic Hierarchy Process (AHP) results found that "Empty Stock at the Distributor and Wrong Branch Selection" are the leading causes of delays in the distribution of medication to patients with Acute Respiratory Infections (ISPA) in hospitals within the Jakarta area. The SWOT analysis also revealed strategies to enhance the efficiency of pharmaceutical distribution by using an integrated stock monitoring system and Use of Real-Time Stock Monitoring System and strategically collaborating with distributors. In addition, close strategic collaboration with distributors was also identified as a key step to speed up the distribution process, reduce the risk of shortages or overstocks, and improve customer satisfaction through more timely and efficient deliveries. Integrated AHP-SWOT approach focused on optimizing supply chain management can suggest strategy improving hospital procurement processes, and reducing ISPA medication distribution delays is

necessary to enhance the quality of medical services in Jakarta.

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