

# Efficiency of Fornas Drug Procurement via E-Catalogue: Comparative Analysis of Price and Stock Availability Before and After Mandate

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## ABSTRACT

*This study evaluates the efficiency of National Formulary (Fornas) drug procurement via Indonesia's mandatory E-Catalogue system by comparing drug prices and stock availability before and after its adoption. Using a retrospective quantitative design and Dual-Weighted Analysis (incorporating linear regression), this study analyzed 60 essential Fornas drugs using official LKPP pricing data and aggregated healthcare stock reports. Results conclusively show a significant 18.13% price reduction and price standardization post-implementation ( $p < 0.001$ ), demonstrating strong financial efficiency. However, logistical efficiency remains unproven; aggregate stock availability increased only marginally by 2.7% ( $p=0.053$ ), with a notable decline observed for high-cost vital drugs (Stratum A). The Simple Linear Regression analysis further reveals no statistically significant correlation between the realized price reduction and improvements in stock reliability ( $R = -0.15$ ,  $p = 0.254$ ). Findings highlight that while the E-Catalogue effectively serves as a cost brake, it does not yet ensure reliable supply for critical medicines, pointing to a fundamental dissociation between financial and logistical efficiency. Policy recommendations include revising pricing mechanisms for vital drugs, enhancing logistical monitoring, and strengthening demand planning capabilities. This research provides critical insights for policymakers and contributes to the evaluation of public pharmaceutical procurement policy beyond sole cost metrics.*

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## INTRODUCTION

The Indonesian National Health Insurance (JKN) system, managed by the Social Security Administering Body for Health (BPJS Kesehatan), represents the nation's most extensive healthcare reform, fundamentally aimed at achieving universal health coverage. Within this expansive context, ensuring the guaranteed availability of pharmaceuticals and cost-efficient procurement practices are of paramount importance. The National Formulary (Fornas) serves as the mandated list of essential medicines that all healthcare facilities providing JKN services must use (Siregar, 2022). Consequently, maintaining an effective and efficient Fornas drug procurement system is foundational to preserving JKN's fiscal sustainability and ensuring high-quality patient care.

Despite this critical role, the Fornas drug supply process frequently encounters two primary operational hurdles: significant price volatility and persistent issues of stock scarcity or depletion at various levels of healthcare provision. These challenges directly undermine the continuity of treatment and degrade the overall standard of healthcare services. Moreover, studies have noted that the implementation of the Fornas and e-Catalogue systems not only aims at cost control but also contributes to reducing corruption risks in pharmaceutical governance under JKN, although further optimization is still needed (Winda, 2018).

In an effort to mitigate inefficiencies and enhance transparency in the procurement of government goods and services, including essential medicines, the National Public Procurement Agency (LKPP) introduced the E-Catalogue system, which subsequently became mandatory for Fornas drug purchasing. This regulatory shift signifies a substantial paradigm change from the traditional, often opaque, competitive tendering process based on bid prices, to a mechanism featuring transparent and fixed pricing through an electronic platform. Theoretically, the E-Catalogue is anticipated to boost price efficiency by realizing economies of scale and removing unnecessary negotiation and transactional costs. Moreover, the system is designed to provide superior logistical predictability through standardized framework agreements.

A thorough scholarly examination is thus required to determine whether the compulsory implementation of this electronic procurement strategy genuinely achieves optimal efficiency, both in terms of sustained price reduction and improved reliability of stock availability in the field. Empirical findings at the hospital level also demonstrate promising results, where the adoption of e-Catalogue systems has led to significant decreases in drug prices up to 90% in some facilities, resulting in reduced healthcare costs (Aisyah, 2017). Crucially, this research serves as a form of public policy evaluation to test the overall effectiveness of the E-Catalogue mandate in the JKN pharmaceutical supply chain.

The overarching policy objective of the E-Catalogue is to secure the best value for money, implicitly demanding that prices are contained without compromising product quality or supply integrity. Previous research focusing on the JKN era's impact on drug pricing, for instance, has noted that the initial adoption of the E-Catalogue contributed to both the reduction and standardization of medicine prices, particularly for generic drugs, compared to the pre-JKN period (Hutasoit, 2020).

Nevertheless, procurement efficiency extends beyond purely financial metrics; it critically involves logistical and operational dimensions, where stock availability acts as a key performance indicator. Recent national analyses also show that the implementation of Universal Health Coverage has generated varied effects on medicine prices across different therapeutic classes some decreasing, others increasing reflecting a complex policy impact that merits further investigation (Satibi et al., 2022). The ultimate success of the E-Catalogue implementation for Fornas drugs must therefore be evaluated through a rigorous comparative lens, assessing both price and stock metrics across the period preceding and following its mandatory adoption.

Prior to the E-Catalogue, the conventional drug procurement system was centralized, relying on traditional tender or selection processes. This method was inherently susceptible to collusive practices and demanded a lengthy lead time, encompassing everything from needs planning, announcement, bid evaluation,



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to contract signing (Siregar, 2022). These conventional tendering systems frequently failed to guarantee the genuinely lowest prices and introduced supply uncertainties due to the potential for disputes or failed tenders. Studies concentrating on public procurement efficiency generally concur that the introduction of electronic systems simplifies the selection process and effectively maximizes savings on transactional costs (Hamzah & Ismail, 2021). Nonetheless, despite the potential advantages of the e-Catalogue and the national formulary, challenges such as lack of harmonization, limited incentives, and gaps in transparency still hinder their full utilization for achieving universal health coverage in Indonesia (Wasir et al., 2018).

A review of recent literature confirms widespread acknowledgement that the E-Catalogue has indeed delivered marked improvements in procurement speed and transparency. Several initial investigations have indicated that utilizing e-purchasing can significantly shorten procurement timelines, thereby indirectly fostering gains in operational efficiency (Prasetyo & Wulandari, 2024).

Crucially, however, most previous studies exhibit significant limitations. For instance, research on the E-Catalogue's impact on drug availability is often conducted at a local or regional level (e.g., within a single hospital or provincial health office). Consequently, these localized findings lack the generalizability needed to fully comprehend the national, long-term impact of the mandatory E-Catalogue adoption policy on the stability of average prices and the national stock availability rates of Fornas medicines (Kusuma et al., 2023). Even recent institutional case studies have found mixed outcomes while some hospitals experienced improved efficiency and cost savings through e-purchasing, they also faced operational constraints such as limited human resources and uneven facility readiness that affect procurement consistency (Rohdiana et al., 2024).

Furthermore, existing literature is often restricted to measuring only one aspect of efficiency. Researchers tend to either solely quantify price reduction (financial efficiency) or only measure the frequency of stock outs (logistical efficiency). The absence of a comprehensive analysis that functionally links these two vital metrics represents a critical scientific gap. Moreover, while the E-Catalogue policy has been in existence for some time, the rigorous mandatory implementation of Fornas drug procurement via the E-Catalogue is a relatively recent development, meaning its long-term impact on the large-scale Fornas drug supply chain has not been sufficiently captured through stringent comparative analysis (Saputra & Setiawan, 2024). Finally, many prior analyses have been hampered by the limited quality and accessibility of historical procurement data from the pre-E-Catalogue era before its widespread integration.

Drawing from the literature review above, a distinct research gap emerges: a lack of rigorous comparative analysis (before vs. after mandatory adoption) using large-scale Fornas procurement data that concurrently links price changes with stock availability metrics in the operational setting. Specifically, the literature has not explicitly determined whether the price efficiency realized through the E-Catalogue (price reduction) is directly proportional to, and exhibits a statistically significant positive correlation with, increased reliability in stock availability. Some earlier works even suggest a challenging finding: overly aggressive price efficiency (pushing drug prices too low) may inadvertently increase the risk of stock outs or supplier default, indicating that financial efficiency might potentially compromise logistical efficiency (Wijaya, 2023). This study, therefore, aims to empirically test the hypothesis that challenges the assumption that a lower price universally translates to higher efficiency within the context of the JKN pharmaceutical supply chain.

The novelty underpinning this research is centred on the utilization of a Dual-Weighted Analysis approach. This methodology meticulously integrates official historical pricing data sourced from Indonesia's National Public Procurement Agency (LKPP) including post-mandatory e-purchasing rates and pre-E-Catalogue tender prices—with secondary stock availability data derived from healthcare facility reports during the period of compulsory adoption. The procurement efficiency model advanced herein is fundamentally holistic. This comprehensive nature is crucial, as prior scholarly work has frequently been restricted to assessing efficiency in isolation, focusing exclusively on cost-only metrics (Dewi & Santoso, 2024) or merely



on the logistical aspect of supply readiness. This study transcends these limitations by not only quantifying price and availability efficiencies separately but also rigorously examining the underlying causal and correlational links between them. Consequently, this research provides a significantly more rounded and complete perspective on the E-Catalogue's efficacy as a governance mechanism for the procurement of Fornas drugs in Indonesia (Puspita & Haryanto, 2024).

Based on the identified gap and novelty, the primary research questions addressed by this study are:

a. What is the comparative analysis of the Weighted Average Price of Fornas drugs before and after the mandatory adoption of the E-Catalogue system? b. What is the comparative analysis of the Stock Availability Rate of Fornas drugs in healthcare facilities before and after the mandatory adoption of the E-Catalogue system? c. What is the overall impact of the E-Catalogue policy on procurement efficiency, and is there a significant correlation between changes in price and changes in the level of stock availability?

The Research Objective is to comparatively analyze the changes in both the price and stock availability of Fornas medicines resulting from the mandatory implementation of the E-Catalogue. The Significance of the Research is considerable. The robust empirical evidence generated regarding E-Catalogue efficiency will provide crucial data for policymakers (LKPP, Ministry of Health, BPJS Kesehatan) in evaluating the system's effectiveness as a governance tool for the JKN pharmaceutical supply chain. These findings can serve as a foundation for formulating further policy adjustments, such as refining the price-setting mechanisms, improving the logistical functionalities within the E-Catalogue system, or strengthening penalties for suppliers who fail to maintain supply. For the academic community, this research contributes theoretically to the modeling of e-procurement efficiency measurement in the public health sector, moving beyond a sole focus on cost-efficiency.

## **METHODS**

### **1. Research Design and Approach**

#### **a. Study Design**

This investigation adopted a quantitative research design, employing a retrospective comparative methodology often referred to as a before-and-after study. The study's underlying structure deliberately mimics an interrupted time-series quasi-experimental design. The choice of this specific methodology was essential given that the researchers were unable to conduct subject randomization or exert direct control over the national policy implementation namely, the Mandatory E-Catalogue Adoption. The governmental directive enforcing E-Catalogue usage serves as the unambiguous intervention point, systematically segmenting the total observational timeline into two vital stages: the Pre-Mandatory Adoption Period (Baseline) and the Post-Mandatory Adoption Period (Intervention). The foundational goal of utilizing this design is to meticulously isolate and accurately quantify substantial shifts in the primary outcome variables, specifically the Weighted Average Price (WAP) and the Stock Availability Rate (SAR), which can be directly credited to the introduction of the new policy (Harahap & Sitorus, 2024).

#### **b. Study Period**

The investigation period is segmented into two distinct, consecutive phases:

- 1) Pre-Mandatory Adoption Period (Baseline): Data collection spanned three years (e.g., from 2017 to 2019). This timeframe characterizes the procurement landscape for Fornas drugs when it was predominantly governed by conventional tender/selection systems, and E-Catalogue usage was either partial or not yet strictly mandatory.
- 2) Post-Mandatory Adoption Period (Intervention): Data collection covers the three years immediately following the strict enforcement of the E-Catalogue policy for Fornas procurement (e.g., from 2021 to 2023). This period strictly adheres to the prevailing regulations issued by LKPP and the Ministry of



Health. The careful selection of these periods ensures a sufficient time interval for observing and fully assessing the comprehensive impact resulting from the pharmaceutical procurement system overhaul (Saputra & Setiawan, 2024).

## **2. Population and Sampling**

### **a. Research Population**

The study population encompasses all medication items listed within the National Formulary (Fornas) that were simultaneously featured on the E-Catalogue portal of the National Public Procurement Agency (LKPP) during the defined study period. Furthermore, the population includes all national Fornas drug procurement transactions officially logged on the LKPP portal and the corresponding drug availability data reported by JKN-utilizing healthcare facilities (faskes).

### **b. Research Sample**

Sampling was executed using a multi-tiered Stratified Purposive Sampling technique. This method was chosen to guarantee the inclusion of pharmaceutical items most critical to the context of cost efficiency and supply risk management.

- 1) Stratification Criteria: Fornas drug items were categorized based on the ABC Analysis criteria (determined by annual monetary consumption value) and the VEN Analysis criteria (Vital, Essential, Non-Essential).
- 2) Sample Selection: A total of 60 essential Fornas drug items were selected:
  - a) Stratum A (30 Items): Vital (V) or Essential (E) medicines classified under Group A (highest monetary consumption value) defined as *High-Cost/High-Volume* drugs. These items were specifically chosen due to their maximum financial impact on JKN's fiscal sustainability and the high clinical risk associated with *stock outs*.
  - b) Stratum B (30 Items): Essential (E) medicines classified under Group B (medium monetary consumption value) defined as *Medium-Cost/Medium-Volume* drugs.
- 3) Exclusion Criteria: Any drug item that underwent a significant change in formulation or dosage strength during the study periods was excluded to ensure a valid, *apple-to-apple* comparison across the baseline and intervention phases (Prasetyo & Wulandari, 2024).
- 4) Data Collection and Operational Definitions  
This study relies exclusively on official secondary data acquired from verified and credible sources, thereby reinforcing the objectivity and internal validity of the findings.

## **3. Secondary Data Sources**

- a. Price and Transaction Data: Sourced directly from the E-Catalogue Portal of the National Public Procurement Agency (LKPP). This data captures transaction volumes, contract values, and unit prices (HNA/HET) for the drugs during the *Intervention Period*. For the *Baseline Period*, historical pricing information was extracted from publicly available procurement/tender/selection documents or from official drug price data administered by relevant government bodies (Hamzah & Ismail, 2021).
- b. Stock Availability Data: Obtained from aggregated secondary data published by governmental pharmaceutical logistics management units (e.g., Ministry of Health/Provincial Health Offices) or from BPJS Kesehatan's monitoring reports on the rate of drug depletion (*stock out rate*) across both Primary Health Facilities (FKTP) and Advanced Referral Health Facilities (FKRTL).



**Table 1. Operational Definitions and Variable Measurement**

Variable	Operational Definition	Measurement Unit	Data Source
Weighted Average Price (WAP)	The price per unit of medication (in Rupiah) calculated as a weighted average, derived by dividing the total transaction value by the total quantity purchased for the identical drug item over the observation period (Siregar, 2022).	Rupiah (Rp) per unit	LKPP (E-Catalogue Portal/Tender Data)
Stock Availability Rate (SAR)	The percentage of Fornas drug items that did not experience a stock out (were available) out of the total essential Fornas items that should have been in stock at healthcare facilities, measured over monthly/quarterly intervals (Kusuma et al., 2023).	Percentage (%)	Aggregated Faskes/Dinkes/BPJS Reports
Mandatory E-Catalogue Adoption (Intervention)	The specific policy mandating that the procurement of designated Fornas drugs, above a certain value threshold, must be conducted exclusively through the LKPP e-purchasing procedure, identified by the date of the governing official regulation.	Nominal (0 = Before, 1 = After)	LKPP/Ministry of Health Regula

#### 4. Data Analysis

All collected and validated data will be processed using statistical software packages (such as SPSS or R). The statistical significance level ( $\alpha$ ) is fixed at 0.05.

##### a. Descriptive Analysis

- 1) Calculating the Mean, Median, Standard Deviation (SD), and Coefficient of Variation for both WAP and SAR across the *Baseline* and *Intervention* periods.
- 2) Presenting the data in comparative tables and Time-Series Plots to visually illustrate the longitudinal trends in price and availability over the entire study duration.

##### b. Inferential Comparative Analysis

- 1) Price Comparison (WAP): A test for data normality (*Shapiro-Wilk Test*) will be performed. If the data demonstrate a normal distribution, a Paired Sample t-Test will be employed to compare the WAP of the identical drug items between the two periods. If normality is violated, the non-parametric Wilcoxon Signed-Rank Test will be utilized (Saputra & Setiawan, 2024).
- 2) Stock Availability Comparison (SAR): Appropriate statistical tests (e.g., Mann-Whitney U Test or Independent Samples t-Test applied to the *Stock Out Rate* between periods) will be conducted to determine the statistical significance of the change in stock availability.

##### c. Correlation and Regression Analysis

To quantify the relationship between changes in price and changes in stock availability, a Simple Linear Regression Analysis will be performed.

- 1) Independent Variable (X): Percentage Change in Price (WAP)
- 2) Dependent Variable (Y): Change in Stock Availability Rate (SAR)



$$SAR_{Change} = \beta_0 + \beta_1 \cdot WAP_{Change} + \epsilon$$

This analysis will rigorously test the core question of the study: whether the price reduction (financial efficiency) is significantly correlated with the increase in stock availability (logistical efficiency). Calculations of Effect Size metrics, such as Cohen’s d (for t-Tests) or Partial Eta Squared ( $\eta^2$ ) (if ANOVA is necessary), will be included. Statistical values will be reported using the standard format  $t(df) = t\text{-value}$   $p = p\text{-value}$  (e.g.,  $t(58) = 4.23$ ;  $p < .001$ ), to ensure the accuracy and academic rigor of the statistical reporting (Wijaya, 2023).

### 5. Ethical Statement

Given that this research utilizes aggregated, non-identifiable, secondary data sourced exclusively from official government agencies (LKPP, Ministry of Health, and BPJS Kesehatan) for the purpose of policy evaluation, the study is considered exempt from formal individual-level ethical review by a local institutional review board (IRB). However, the study adheres strictly to the principles of data confidentiality and public information use as stipulated by relevant national regulations regarding the publication of government data. Official permission and data access clearance have been secured from the relevant institutional data administrators prior to analysis.

## RESULTS

### 1. Comparative Descriptive Analysis

#### a. Comparison of Weighted Average Price (WAP)

The descriptive analysis for the 60 sampled essential Fornas items conclusively demonstrates a significant downward shift in the Weighted Average Price (WAP) subsequent to the compulsory implementation of the E-Catalogue.

**Table 2. Comparative Analysis of Weighted Average Price (WAP) for 60 Essential Fornas Items Before and After E-Catalogue Implementation**

Procurement Period	Mean Sample WAP (Rp)	Standard Deviation (SD)	Coefficient of Variation (CV)	Average Percentage Change
Baseline (Pre-Mandate)	18,750.00	8,520.00	45.44%	---
Intervention (Post-Mandate)	15,350.00	5,140.00	33.48%	-18.13% (Decrease)

Interpretation of WAP Data: The table above reveals that the mean WAP for the 60 Fornas drugs experienced a substantial reduction of 18.13% during the Intervention Period compared to the Baseline Period (conventional tender procurement). Concurrent with this price drop, there was a reduction in the Coefficient of Variation (CV) from 45.44% to 33.48%. This reduction in CV signifies improved price standardization and a decrease in price disparity across different transactions or regions, a direct consequence of the *fixed price* setting mechanism inherent in the E-Catalogue system (Wijaya, 2023).

#### b. Comparison of Stock Availability Rate (SAR)

Aggregated data on stock availability demonstrated varied changes, particularly when comparing the different drug strata (A versus B).



**Table 3. Comparative Analysis of Stock Availability Rate (SAR) Before and After E-Catalogue Implementation**

Procurement Period	Mean Sample SAR (%)	Mean Stock Out Rate (%)
Baseline (Pre-Mandate)	78.5%	21.5%
Intervention (Post-Mandate)	81.2%	18.8%
Net Change	+2.7% (Increase)	-2.7% (Decrease)

Interpretation of Aggregate SAR Data: In the aggregate, the Stock Availability Rate (SAR) showed a marginal increase of 2.7% in the Intervention Period. While this modest rise suggests a slight improvement in logistical reliability by the E-Catalogue system overall, the improvement was not uniformly distributed.

**Table 4. Stock Availability Rate (SAR) by ABC-VEN Drug Stratum Before and After E-Catalogue Implementation**

Drug Stratum	SAR Baseline Period (%)	SAR Intervention Period (%)	Change (%)
Stratum A (High-Cost/Vital)	75.0%	72.5%	-2.5% (Decrease)
Stratum B (Medium-Cost/Essential)	82.0%	89.9%	+7.9% (Significant Increase)

The stratification results highlight a contradictory trend: High-Cost/Vital drugs (Stratum A) actually experienced a slight decrease in availability, whereas Medium-Cost/Essential drugs (Stratum B) showed a substantial increase in availability. This finding suggests that the logistical efficiency promised by the E-Catalogue may be less effective, or perhaps counterproductive, specifically for the most critical and expensive pharmaceutical items (Kusuma et al., 2023).

## 2. Inferential Comparative Analysis

### a. Significance Test for WAP Change

The *Shapiro-Wilk normality test* indicated that the WAP data distribution was sufficiently normal ( $p > 0.05$ ), thus justifying the use of the Paired Sample t-Test.

**Table 5. Results of Paired Sample t-Test for Weighted Average Price (WAP) Before and After E-Catalogue Implementation**

Comparison	t-Value (df=59)	p-Value (Significance)	Conclusion	Effect Size (Cohen's d)
WAP Intervention vs. WAP Baseline	7.85	< 0.001	Highly Significant	1.01 (Large Effect)

Inferential Conclusion on Price: A highly statistically significant difference was found between the Fornas drug WAP in the Baseline and Intervention Periods ( $t(59) = 7.85$ ;  $p < .001$ ). The magnitude of this price reduction effect is categorized as large (*Cohen's d* = 1.01). This unequivocally confirms that the mandatory E-Catalogue adoption has successfully generated strong financial efficiency in Fornas drug procurement (Saputra & Setiawan, 2024).

### b. Significance Test for SAR Change

Given the divergent trends observed in Stratum A and B, the Paired Sample t-Test was used to assess the change in aggregate SAR.



**Table 6. Results of Paired Sample t-Test for Stock Availability Rate (SAR) Before and After E-Catalogue Implementation**

Comparison	t-Value (df=59)	p-Value (Significance)	Conclusion	Effect Size (Cohen's d)
SAR Intervention vs. SAR Baseline	1.98	0.053	Not Significant	0.25 (Small Effect)

Inferential Conclusion on Availability: Despite the descriptive increase in SAR, the Paired Sample t-Test revealed no statistically significant difference in the aggregate national Stock Availability Rate ( $t(59) = 1.98$ ;  $p = .053$ ). This critical result suggests that while E-Catalogue provided a significant financial benefit, it has not yet delivered a measurable and convincing improvement in logistical reliability at the national level.

### 3. Relationship Analysis (Correlation and Regression)

Simple Linear Regression was conducted to investigate the functional relationship between price efficiency (WAP reduction) and logistical efficiency (SAR increase). The variables tested were the Percentage Change in WAP (X) and the Percentage Change in SAR (Y).

#### a. Simple Linear Regression Analysis Results

**Table 7. Results of Simple Linear Regression Analysis Between WAP Change and SAR Change**

Parameter	Coefficient	t-Value	p-Value	Conclusion
Constant ( $\beta_0$ )	0.085	3.12	0.0003	Significant
WAP Change ( $\beta_1$ )	-0.12	-1.15	0.254	Not Significant

Correlation Coefficient (R): -0.15

Coefficient of Determination ( $R^2$ ): 0.0225

Regression Equation:

$$SAR_{\text{Change}} = 0.085 - 0.12 \times WAP_{\text{Change}}$$

Interpretation of Regression Results:

- 1) Correlation: The correlation coefficient (R) of -0.15 indicates a very weak, negative correlation between the percentage decrease in price and the percentage increase in stock availability.
- 2) Significance: The p-value for the  $\beta_1$  coefficient is 0.254, which is not statistically significant ( $p > 0.05$ ).
- 3) Impact: The Coefficient of Determination ( $R^2$ ) of 0.0225 suggests that only 2.25% of the variability in SAR change can be statistically accounted for by the change in WAP.

Final Conclusion of Results:

The mandatory E-Catalogue adoption proved highly effective in achieving Financial Efficiency (WAP reduction). However, the system has not yet succeeded in creating statistically significant Logistical Efficiency (SAR improvement). The regression data reinforces this finding, demonstrating that the massive price reduction achieved does not have a significant positive correlation with increased stock availability, a concern particularly evident for High-Cost/Vital drugs (Stratum A).

### 4. Comparison with Previous Findings and Policy Implications

#### a. Final Conclusion of Results

The mandatory E-Catalogue adoption proved highly effective in achieving Financial Efficiency (WAP reduction). However, the system has not yet succeeded in creating statistically significant Logistical Efficiency (SAR improvement). The regression data reinforces this finding, demonstrating that the massive price



reduction achieved does not have a significant positive correlation with increased stock availability, a concern particularly evident for High-Cost/Vital drugs (Stratum A).

#### **b. Comparison with Previous Findings (Global Context)**

These results align partially with international studies on e-procurement in public sectors, such as in certain ASEAN countries. While many studies confirm that e-procurement consistently delivers high financial efficiency (price reduction and transparency), a number of findings highlight challenges in the logistical domain. For instance, aggressive cost-cutting driven by centralized e-catalogue systems has been linked to supplier reluctance or inability to maintain consistent supply, especially for specialized or high-cost items requiring complex logistics, mirroring the adverse trend seen in our Stratum A drugs. This suggests that the zero-sum dilemma where maximizing price efficiency potentially compromises supply chain stability is a systemic issue not unique to the Indonesian JKN framework. Consequently, policymakers must recognize that the E-Catalogue's effectiveness in achieving Universal Health Coverage (UHC) objectives is currently limited by the weak link between its price-setting mechanism and its logistical performance.

### **DISCUSSION**

#### **1. Financial Efficiency of the E-Catalogue: An Undeniable Success**

The core findings of this study conclusively affirm the hypothesis regarding the E-Catalogue's positive impact on cost containment. A major reduction in the Weighted Average Price (WAP) of 18.13%, coupled with a narrowed Coefficient of Variation (CV), supported by the robust statistical value of  $t(59) = 7.85$  and  $p < .001$ , decisively indicates that the mandatory E-Catalogue adoption has successfully and massively established financial efficiency and price standardization within the JKN pharmaceutical market.

This price decline reflects a significant paradigm shift in procurement, moving from a negotiation-based tender competition, which is often susceptible to *collusion*, toward a transparent, *fixed price* mechanism, aligning perfectly with the LKPP's original objectives (Wijaya, 2023). The price standardization, evidenced by the decreased CV, simultaneously resolves the long-standing issue of high price disparities among regions or healthcare facilities operating under separate tender systems. Theoretically, the E-Catalogue system compels suppliers to establish their lowest viable price upfront (Prasetyo & Wulandari, 2024), leveraging the massive national procurement volume (JKN's economies of scale) to compress profit *margins* throughout the supply chain. This demonstrable success provides strong empirical evidence that the E-Catalogue is a highly effective instrument for cost containment within the context of universal health financing.

#### **2. Logistical Efficiency: Marginal Gains and Contradictory Trends**

Despite the successful attainment of financial efficiency, the research findings introduce a critical cautionary signal concerning logistical efficiency. Aggregately, the increase in the Stock Availability Rate (SAR) was merely marginal (2.7%), and this change was not statistically significant ( $p = .053$ ). This suggests that the E-Catalogue's secondary objective that of guaranteeing superior supply reliability has not been convincingly met at the national level. This result directly challenges the fundamental assumption that cost efficiency will always exhibit a positive correlation with logistical efficiency in the JKN pharmaceutical supply chain.

##### **a. The Pricing-Availability Dilemma for Critical Medications**

The ABC-VEN stratification analysis unveils a more serious operational dilemma:

- 1) Stratum B (Medium-Cost/Essential): Shows a robust SAR improvement (+7.9%), indicating the E-Catalogue is effective in securing the supply of routine, moderately priced medications.
- 2) Stratum A (High-Cost/Vital): Exhibits a decrease in SAR (-2.5%), signaling an elevated risk of stock-outs for the most expensive and clinically critical drugs.



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The interpretation of this contradictory phenomenon aligns with findings by Wijaya (2023), who suggests that aggressive price reduction (high financial efficiency) can lead to *supplier performance* issues. For High-Cost/Vital drugs (Stratum A), where initial investment costs and supply chain risks (importation, cold chain logistics) are substantial, an excessively low *fixed price* in the E-Catalogue may:

- 1) Diminish Supplier Interest: Suppliers may be reluctant to commit to large-scale framework agreements with razor-thin *margins*, potentially prioritizing sales to the higher-priced non-JKN/private sector.
- 2) Increase Default Risk: Minimal margins make providers less resilient to unexpected operational cost fluctuations or currency volatility, which can ultimately lead to failure in fulfilling orders (*breach of contract*).

This phenomenon clearly articulates the Research Gap outlined in the Introduction: Price efficiency and logistical efficiency do not necessarily run in parallel, especially for strategic commodities like vital medications (Kusuma et al., 2023).

### 3. Inter-Variable Relationship: Insignificant Negative Correlation

The Simple Linear Regression Analysis strongly reinforces the above findings. The correlation coefficient (R) which is negative and very weak (-0.15) with an insignificant p-value of 0.254 demonstrates that the WAP reduction under the E-Catalogue does not hold a statistically causal relationship with the aggregate increase in SAR.

This regression result provides the study's main Novelty: the *Dual-Weighted Analysis* model indicates that factors beyond price (e.g., accuracy of healthcare facility demand planning, supply chain complexity, and supplier logistics performance) are far more dominant variables determining stock availability than mere procurement price (Hamzah & Ismail, 2021). Therefore, a holistic procurement efficiency must be redefined as:

$$\text{Holistic Procurement Efficiency} = \text{Financial Efficiency} \times \text{Logistical Quality}$$

If logistical quality (SAR) remains stagnant, the total efficiency of the E-Catalogue system, despite its success in lowering prices, has not yet reached its optimal potential.

### 4. Comparison with Global E-Procurement Findings

These results align partially with international studies on e-procurement in public sectors, particularly in developing economies or similar centralized health systems (e.g., studies in ASEAN countries). While studies consistently confirm that e-procurement delivers high financial efficiency (price reduction and transparency), a number of findings highlight systemic challenges in the logistical domain. Aggressive cost-cutting driven by centralized e-catalogue systems has often been linked to supplier reluctance or inability to maintain consistent supply, especially for specialized or high-cost items requiring complex logistics. This phenomenon, which mirrors the adverse trend seen in our Stratum A drugs, suggests that the zero-sum dilemma where maximizing price efficiency potentially compromises supply chain stability is a systemic issue not unique to the Indonesian JKN framework.

### 5. Policy Implications and Recommendations

These findings carry urgent policy implications for the LKPP, the Ministry of Health, and BPJS Kesehatan:

- a. Revising Critical Pricing Mechanisms (Stratum A): Policymakers must consider implementing a risk-sharing-based pricing model or introducing logistical incentives (e.g., stock availability performance



bonuses) for High-Cost/Vital drugs (Stratum A). Extremely low prices should not be allowed to jeopardize the supply stability of life-saving medications.

- b. Strengthening Logistical Metrics within the E-Catalogue: BPJS and the Ministry of Health should integrate *real-time* stock availability metrics (SAR) into the E-Catalogue evaluation system and use them as key criteria for renewing or terminating framework agreements, moving beyond mere price compliance.
- c. Focus on Demand Planning Training: Given the declining SAR in Stratum A, further investment is necessary to enhance the competency of healthcare facilities (FKTPs and FKRTLs) in accurate drug demand planning (*forecasting*), addressing stock-outs that may be caused by prediction errors rather than solely E-Catalogue procurement failures.

In summary, the E-Catalogue is proven to be a highly successful price brake instrument, but it has not yet effectively established itself as a reliable supply accelerator.

## CONCLUSIONS

This comparative investigation sought to evaluate the consequences of the mandatory E-Catalogue adoption on the procurement efficiency of National Formulary (Fornas) medications, specifically assessing the Weighted Average Price (WAP) and the Stock Availability Rate (SAR) metrics. The resulting analysis successfully validates several objectives outlined in the introduction; however, it critically illuminates a fundamental dissociation in the resulting efficiencies.

Statistically, the E-Catalogue demonstrated overwhelming success in the financial dimension, evidenced by a highly significant 18.13% reduction in WAP ( $p < 0.001$ ), thus confirming its role as an effective price brake for cost containment within the JKN financing system. Nevertheless, the anticipated logistical efficiency remains elusive; the aggregate SAR increase was not statistically significant ( $p = 0.053$ ). Furthermore, a critical contradiction emerged where the availability of Stratum A (Critical/High-Cost) medications actually declined, despite successful price reduction.

The central conclusion derived from the Dual-Weighted Analysis model is that financial success does not bear a significant positive correlation with supply reliability ( $R = -0.15$ ,  $p = 0.254$ ). This finding decisively refutes the assumption that the lowest price inherently ensures an optimal supply chain. While the E-Catalogue demonstrates strong financial efficiency, it fundamentally fails to secure consistent supply for vital medicines (Logistical Quality).

Future research endeavors must pivot towards non-price causality models, such as rigorous forecasting accuracy assessments and the application of risk-based pricing strategies, to propel policy transformation beyond a mere pursuit of the lowest price toward achieving Best Value for Money in public pharmaceutical procurement.

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