

Analysis and Standardization of Cost of Goods Manufactured in the Pharmaceutical Holding Company to Support Strategic Decision-Making

Anugrah Wardhani^{1*}, Etty Gurendrawati², Unggul Purwohed³

¹⁻³Master's Program in Accounting, Faculty of Economics and Business, Universitas Negeri Jakarta, Indonesia

E-mail: ¹⁾ anwdhani@gmail.com

ARTICLE INFO

Article History

Received : 11.07.2026
Revised : 26.08.2026
Accepted : 02.09.2026

Article Type :
Research Article



ABSTRACT

The Pharmaceutical Holding Company was established to strengthen the national pharmaceutical industry and reduce reliance on imported Active Pharmaceutical Ingredients (APIs), yet its three subsidiaries entered the group with differing cost accounting systems and structures. This study employs a project-based research approach with a descriptive-quantitative design, drawing on data from a COGM standardization project conducted at the Pharmaceutical Holding, collected through documentation review, focus group discussions, and site visits. The findings indicate that COGM disparities between PT ABC and PT DEF for intersecting products are largely attributable to differences in cost scope, Cost Center structure, and conversion cost allocation methods, rather than genuine differences in production efficiency. The study also reveals significant disparities in production capacity utilization across entities, providing a concrete basis for holding-level strategic decisions on production order reallocation and capacity investment planning. The standardization of direct material and conversion costs formulated in this study is shown to produce a more equivalent (apple-to-apple) basis for comparing COGM across entities, and to provide more relevant information for holding management in strategic decisions related to long-term pricing, unit performance evaluation for identifying centers of excellence, and cross-entity investment/capacity allocation. This study recommends establishing the COGM standardization guideline as an official holding cost accounting policy, accompanied by a cross-entity ERP data integration strategy to support ongoing cost consolidation and monitoring in support of holding-level strategic planning.

Keywords: Cost of Goods Manufactured, Cost Standardization, Enterprise Resource Planning, Pharmaceutical Holding, Strategic Decision-Making

1. INTRODUCTION

The pharmaceutical industry is a strategic sector that underpins national health security, yet it also faces significant cost pressures due to its reliance on imported Active Pharmaceutical Ingredients (APIs), which account for around 90 per cent of its needs, stringent production regulations, and increasingly fierce price competition in both domestic and global markets. In response to these challenges, in early 2020 the Ministry of State-Owned Enterprises (BUMN) established the Pharmaceutical Holding Company, comprising three pharmaceutical companies, namely PT IBU, PT ABC and PT DEF, with PT IBU acting as the holding company's parent.

The primary objective of establishing this holding company is to strengthen the national pharmaceutical industry by improving product availability and fostering joint innovation, whilst simultaneously achieving efficiency in raw material sourcing by reducing the reliance on imported APIs from around 90 percent to 75 percent. With these efficiencies, pharmaceutical products are expected to become more affordable whilst also increasing the overall scale of the holding company's business.

Within the context of a holding company, the cost of goods manufactured (COGM) is one of the most crucial pieces of cost accounting information for management when making various strategic and tactical decisions, ranging from setting product selling prices, evaluating the performance of production units across entities, deciding on product mix, to decisions regarding investment allocation and the consolidation of

production capacity at the holding company level. The accuracy and consistency of COGM across entities are an absolute prerequisite for ensuring that the cost information presented is truly reliable and comparable as a basis for the holding company's management decisions, rather than merely the accounting records of each standalone entity.

However, prior to joining the holding company, PT IBU, PT ABC and PT DEF operated independently, each with different systems, production organisational structures, cost classifications and cost accounting practices. Differences in cost of goods manufactured between entities may be caused by several factors, such as differences in the composition of raw materials (Bill of Materials), differences in labour rates, and differences in overhead cost allocation methods. This lack of uniformity makes it difficult for the holding company to carry out an 'apple-to-apple' comparison of cost efficiency between subsidiaries, and risks producing misleading cost information if used directly as a basis for decision-making at corporate level, for example, in determining which entity is most efficient at producing a particular product (Asharudin & Sululing, 2018).

To address these needs, a project was undertaken to standardise the cost of goods manufactured across the three subsidiaries of the Pharmaceutical holding company. This included an analysis of the current state of production cost calculations, the formulation of standard costs for raw materials and conversion costs, a simulation of cost of goods manufactured calculations based on standard costs for overlapping products (products manufactured by more than one subsidiary), as well as a study on the integration of the Enterprise Resource Planning (ERP) system to support cost accounting standardisation at holding company level. This thesis is based on the results of that project, with the discussion focusing on the holding company's three main entities, namely PT IBU as the parent company, PT ABC, and PT DEF as subsidiary entities producing overlapping products, in order to assess the extent to which the results of COGM standardisation can serve as a reliable information basis for the holding company's management decision-making.

In an era of globalisation and increasingly fierce business competition, companies are required to have effective competitive strategies in order to ensure business continuity and enhance corporate value. One widely used competitive strategy is cost leadership, which refers to a company's ability to become the lowest-cost producer in its industry without compromising the quality of its products or services (Horngren et al., 2010). This strategy enables companies to offer more competitive prices whilst achieving optimal profit margins. According to Porter (2008), cost leadership is one of the generic strategies that can help companies achieve a sustainable competitive advantage.

For companies operating as holding companies, achieving cost leadership presents its own set of challenges and opportunities. A holding company is a parent company that exercises control over one or more subsidiaries, with the aim of creating synergies, efficiency and the consolidation of resources (Ficbauer & Režňáková, 2014). Through integrated coordination, a holding company can control costs, standardise processes and optimise the use of assets across companies within the group. It is hoped that this synergy will generate economies of scale and economies of scope, thereby reducing production and operational costs.

However, in practice, the implementation of a cost leadership strategy within a holding company faces several obstacles. Firstly, differences in organisational structure and accounting systems across the various subsidiaries can lead to inefficiencies (Anthony & Govindarajan, 2007). Secondly, the potential for agency problems in financial management between the holding company and its subsidiaries can increase coordination costs. Thirdly, the consolidation of financial statements requires robust internal control mechanisms to ensure that cost efficiencies are truly achieved (Garrison et al., 2010).

The role of accounting, particularly management accounting and cost accounting, is crucial in supporting the holding company in achieving its cost leadership strategy. Accurate cost accounting information enables management to measure efficiency, conduct variance analysis, and make strategic decisions regarding the control of production costs, supply chain management, and investment policies. According to Mowen and Hansen (2017), an integrated cost accounting system can enhance cost transparency and provide relevant information to support cost control. Furthermore, the implementation of accounting information technology can help accelerate data consolidation, reduce duplication of administrative costs, and improve coordination between entities within the group (Romney & Steinbart, 2018).

Consequently, research into how holding companies achieve cost leadership through the implementation of cost accounting and financial management systems is important. This not only makes a theoretical

contribution to the field of management accounting but also provides practical benefits for companies operating under a group structure to enhance their competitiveness through cost efficiency (Rahmasania & Dahtiah, 2022).

Cost of production is a key factor in measuring production efficiency. If the cost of production can be reduced, it is expected that the company will be able to gain a competitive edge through more affordable selling prices (Risnarningsih et al., 2023). Pharmaceutical companies produce medical devices and healthcare products that must, of course, be affordable to all sections of society; consequently, a cost-leadership strategy is relevant in measuring the company's performance.

As part of efforts to improve efficiency and harmonise business processes, the Pharmaceutical Holding Company has implemented a Cost of Production Standardisation Programme involving all entities within the group. The programme aims to establish a uniform methodology for calculating production cost, thereby producing more accurate and comparable cost information to support strategic decision-making at holding company level. Focus Group Discussions (FGDs) were conducted, supplemented by secondary data such as cost structures and production cost reports. This research is expected to contribute to the development of a cost control system and the improvement of operational efficiency within the Pharmaceutical Holding Company.

2. LITERATURE REVIEW

2.1. Cost Concept

Cost is the sacrifice of economic resources, expressed in monetary terms, to obtain goods or services that provide benefits both now and in the future. According to Anthony and Govindarajan (2007); Horngren et al. (2006); Mowen and Hansen (2017); as well as Mulyadi (2014), cost is regarded as a resource sacrificed to achieve specific objectives; consequently, cost forms the basis for organisational planning, control and decision-making. Costs are classified according to their intended use. For the purpose of identifying cost objects, costs are categorized as direct and indirect costs. For financial reporting, costs comprise product costs and period costs. Based on their behaviour, costs are grouped into variable costs and fixed costs. Meanwhile, in decision-making, differential costs, opportunity costs and sunk costs are recognised, which help management select the most profitable decision alternatives.

2.2. Methods of Calculating The Cost of Goods Manufactured

2.2.1. Process Costing

The process costing method is used by companies that mass-produce homogeneous products through a continuous production process. Costs are accumulated by department or production stage, and then allocated to each unit based on the number of equivalent units produced.

2.2.2. Job Order Costing

Job order costing is applied to production based on specific orders or specifications. Each order has its own cost calculation, so the cost of goods manufactured for each product may vary according to requirements and the resources utilised.

2.2.3. Activity-Based Costing (ABC)

Activity-Based Costing (ABC) allocates overhead costs based on the activities actually consumed by the product through the use of cost drivers (Tahir et al., 2026). This method produces more accurate cost information than traditional methods, particularly in companies with a wide variety of products and complex production processes.

2.2.4. Standard Costing and Variance Analysis

Standard costs are costs that have been set in advance as a benchmark for budgeting, cost control, inventory valuation and performance evaluation. The difference between actual costs and standard costs is called a variance, which may take the form of variances in raw material prices, raw material quantities, labour rates, labour efficiency, and overhead variances. Variance analysis is used to identify the causes of cost deviations and forms the basis for corrective action.

2.3. The Concept of Enterprise Resource Planning (ERP) and Cost Accounting

ERP is an integrated information system that links various company functions, including production, finance, and cost accounting. In the calculation of cost of goods manufactured (COGM), ERP enables a more automated, consistent and integrated process through the use of master data such as the Bill of Materials (BOM), Master Recipe and Cost Centre, thereby improving the accuracy and comparability of cost information across entities.

2.4. The Hierarchy of Managerial Decisions

Managerial decisions consist of strategic, tactical and operational decisions. Strategic decisions relate to investment, production capacity, consolidation and long-term policies, whilst tactical and operational decisions focus more on routine activities such as pricing, product mix and performance evaluation. Within a holding company, strategic decisions require uniform and comparable cost information to ensure that the decisions taken are unbiased.

2.5. The Concept of A Holding Company and Business Synergies

A holding company is a parent company that controls several subsidiaries to create synergies and added value. These synergies can be realised through the standardization of policies, consolidated procurement, technology transfer, ERP harmonisation, and the standardization of cost accounting systems. Consistency in cost of goods sold is a key prerequisite to ensure that cost information across entities can be accurately compared as a basis for strategic decision-making.

3. RESEARCH METHODS

This study employs a project-based research approach with a quantitative descriptive design, focusing on the standardisation of the cost of goods manufactured (COGM) for pharmaceutical products within the State-Owned Pharmaceutical Holding Company. The quantitative descriptive label reflects the nature of the core analytical output of this research, namely the standard cost formulations, price and quantity variance calculations, expenditure and volume variance calculations, and the COGM simulation results across 41 overlapping products, all of which are numerical and comparative in nature; documentation review, Focus Group Discussions (FGDs), and site visits served as the means of collecting and verifying the inputs (cost structures, cost centre data, and production process information) on which these quantitative analyses were based, rather than as the primary basis of analysis itself.

The research was conducted through the following stages: a diagnostic assessment of the current situation, the development of cost standards, a simulation of COGM calculations, and the formulation of recommendations for the integration of an Enterprise Resource Planning (ERP) system. The research subjects included PT IBU as the holding company, and PT ABC and PT DEF as subsidiary entities engaged in the production of medicines. The data used comprised primary and secondary data for the 2023 financial year, obtained through a documentary review, Focus Group Discussions (FGDs) with the cost accounting and production management teams, and site visits to production units to verify business processes and cost centre structures. These three data collection methods were used in a complementary manner to cross-check the information obtained: documentary review provided the recorded cost and production data, FGDs with the cost accounting and production management teams were used to clarify and confirm the interpretation of this documented data, and site visits served to verify that the cost centre structures and business processes described in the documentation and FGDs corresponded with actual production conditions.

Data analysis was conducted in stages through a comparative analysis of the existing conditions, the formulation of standards for direct raw material costs and conversion costs, simulations and variance analysis between standard-cost-based cost of goods manufactured (COGM) and existing COGM, followed by an analysis of ERP implementation and the formulation of strategic recommendations for COGM standardisation. Overall, this study comprises five main stages, namely the identification of the current situation, the formulation of cost standards, COGM calculation simulations, the evaluation of ERP implementation, and the formulation of COGM standardisation recommendations as a basis for the holding company's management decision-making.

These five research stages are organised within a research framework that comprehensively illustrates the flow of inputs, processes, outputs, and outcomes (final impact) of the research, as presented in Figure 1. This framework emphasises that COGM disparities between entities (input) are processed through five sequential and interrelated stages, resulting in COGM standardisation guidelines and ERP integration recommendations (output), which are ultimately projected to contribute to the availability of reliable cost information for the holding company's management decision-making (outcome).

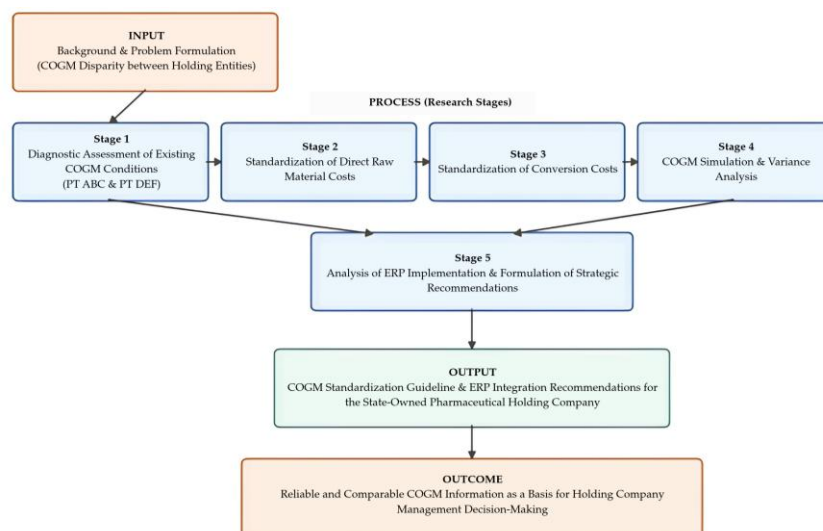


Figure 1. Research Framework

Source: Authors' compilation

4. RESULTS AND DISCUSSION

4.1. Research Results

4.1.1. Comparison of the Current Situation of the Two Entities

Table 1 below summarizes the fundamental differences in the current cost of goods manufactured (COGM) calculations between PT ABC and PT DEF, which form the basis for the standardization process in Stages 2 and 3.

Table 1. Comparison of the Existing Conditions for the Cost of Goods Sold Calculations at PT ABC and PT DEF

Aspect	PT ABC	PT DEF
Coverage of production costs	All costs at plant level, including plant management and administrative labour	All costs under the Directorate of Production; administrative and general staff costs are excluded
Main classifications	Material cost & activity cost (2 groups)	Materials, conversion costs, ancillary costs (3 categories)
Cost composition (indicative)	± 65% material cost, ± 35% activity cost	Not explicitly distinguished in the same report
Pricing of raw materials	Based on the Product Cost Estimate (Quantity Structure) in the Production Planning module	SAP-based planned price, using the moving average as a reference
Standard conversion cost basis	Cost Center Report berbasis Standard Cost Estimate	Hourly rate for the Cost Centre based on the breakdown of the Annual Budget Plan (RKAP) and the Master Recipe
Number and format of variance accounts	Variances at Cost Centre and Cost Element level (not broken down into specific standard accounts)	9 standard variance accounts (Production Variance, COGM Variance, Purchase Price Variance, etc.)

Source: Processed data

The comparison in Table 1 confirms that the disparity in cost of goods manufactured (COGM) between entities does not merely reflect differences in actual production efficiency, but is also influenced by differences in the scope of costs, classification formats and the structure of variance accounts used. It is this situation that underlies the need for standardization of direct raw material costs (Stage 2) and conversion costs (Stage 3) before the COGM of the two entities can be compared on an equal footing at the simulation stage (Stage 4).

4.1.2. Stage 2: Standardization of Direct Raw Material Costs

At this stage, the standardization of direct raw material costs was formulated through three steps: (1) standardizing the classification of raw materials into the categories of active pharmaceutical ingredients (APIs), excipients and packaging materials; (2) establishing consistent methods for measuring and valuing stock across entities; and (3) formulating standard raw material cost formulas and a format for analyzing price and quantity variances in raw materials, which were pilot-tested on a case study of Captopril as one of the key products. The outcome of this stage was an agreement on the classification and valuation methods for raw material stock, as well as the formulation of a variance analysis format that has been pilot-tested on real-world data for Captopril 12.5 mg at PT ABC's Banjaran Unit, as detailed below.

A. Management and Classification of Raw Material Costs

Raw materials are stocks that are processed into higher-value goods through the production process, whether produced in-house or purchased from third parties. Effective raw material management encompasses forecasting requirements, purchasing, receiving, storage, usage and dispatch, and requires appropriate accounting policies to ensure that information on raw material costs can support efficient managerial decision-making. Within a pharmaceutical holding company, direct raw material costs are classified into active pharmaceutical ingredients (APIs), excipients, and packaging materials, which consist of primary and secondary packaging.

B. Measurement and Valuation of Raw Material Stock

Table 2. Price Variance and Quantity Variance of Captopril Raw Materials (F = Favorable, U = Unfavorable)

Name of Raw Material	Category	Price Variation (Rp)	Quantity Variance (Rp)
Captopril	API	1,327,519.04 U	–
Corn Starch	Excipient	645,487.95 U	–
Acidum Silicicum, Koloidal 200	Excipient	2,358.68 U	–
Lactose	Excipient	2,962,715.93 F	–
Magnesii Stearas	Excipient	1,935.32 F	–
Povidone K 30	Excipient	18,512.77 F	–
Talcum (IS)	Excipient	19,463.51 U	–
Poly.Ctk. Captopril 12,5 230 mm	Packaging	857,272.52 F	4,632,943.00 F
Poly. Polos 230 mm 15 UM	Packaging	66,706.01 U	596,476.16 U
Dus Tab Captopril 12,5 mg 10x10	Packaging	40,831.70 F	89,996.40 F
Leaflet Captopril	Packaging	254,063.91 F	33,332.00 F
Cellotape 0,5 Inchi	Packaging	5,603.25 F	–
Box Karton No. 11	Packaging	157,773.23 U	9,143.88 F
Plak Band 2 Inch	Packaging	2,547.34 U	6,876.86 U

Source: Processed data

The results of the analysis in Table 2 show that some of the raw materials for Captopril exhibit unfavorable (U) price variance, for example, the active ingredient Captopril with a price variance of Rp1,327,519.04 U, indicating that the actual purchase price is higher than the standard price, while others are favorable (F), such as lactose with a variance of Rp2,962,715.93 F. It should be emphasized that a favorable variance does not always reflect a positive situation for the company, as it may also be caused by a decline in the quality of the raw materials used (cheaper prices) or the use of quantities below the standard, which could potentially affect the quality of the final product. Therefore, standardizing the format for analyzing raw material variances, as illustrated in this case study, is essential so that the holding company's management can interpret variances consistently and accurately across entities, as a basis for decision-making regarding procurement policies and raw material quality control.

4.1.3. Stage 3: Standardization of Conversion Costs

At this stage, all cost centers at PT ABC and PT DEF were mapped into the categories of Indirect Cost Centers (ICCs) and Direct Cost Centers (DCCs), along with their activity levels. This was followed by the formulation of a two-stage cost allocation scheme (from ICCs to DCCs, then from DCCs to products), as well as the formulation of a standardized format for analyzing expenditure variances and volume variances. As in Stage 2, this approach was piloted on the Captopril case study to verify its feasibility for application to real-world data from both entities. The results of this stage are a comprehensive map of the cost centers for both entities, a standardized cost conversion allocation scheme, and the results of the pilot test on the Captopril data, which revealed disparities in capacity utilization between the entities, as outlined below.

A. Cost Pool Structure

The initial step in standardizing conversion costs involves categorizing all cost centers within each entity into two categories: Indirect Cost Centers (ICC) and Direct Cost Centers (DCC). CCTLs comprise units that serve as operational support and are not directly involved in the production process, such as quality control, quality assurance, engineering and maintenance, logistics, procurement, accounting, warehousing, and other administrative functions. Conversely, CCL comprises units directly involved in the production process, such as granulation, tablet pressing, coating, processing of various dosage forms, filling, formulation, and packaging. In addition to their involvement in the production process, each Cost Center is also grouped according to activity levels, which include facility level, batch level, unit level, and product level. The results of the mapping show that the majority of CCTLs are at the facility and product levels as they serve as support activities, while CCLs are predominantly at the batch level as they are directly related to the execution of the production process. This grouping forms the basis for determining cost allocation methods, enabling conversion cost standardization to be carried out more accurately and to reflect resource consumption in each production activity.

B. Allocation of Conversion Costs

Table 3. Budgeted, Actual and Variance Costs for Captopril Production (F = Favorable, U = Unfavorable)

Cost Center	Entity	Actual Conversion Cost (Rp)	Budgeted Conversion Costs (Rp)	Variation in Expenditure (Rp)
Tablet Granulation Sub-Section, Line I	ABC	39,238,639,698	15,827,534,632	23,411,105,066 U
Tablet Compression Sub-Section, Line I	ABC	10,561,945,186	5,108,991,691	5,452,953,495 U
Primary Packaging Sub-Section	ABC	43,848,975,286	44,748,782,530	899,807,244 F
Secondary Packaging Sub-Section	ABC	27,708,886,726	30,705,106,694	2,996,219,968 F
Final Mixing GPU	DEF	8,595,442,617	8,829,545,414	234,102,796 F
Tableting GPU	DEF	10,059,385,099	12,906,791,319	2,847,406,221 F
Packaging GPU	DEF	46,860,727,306	47,123,345,328	262,618,022 F

Source: Processed data

The data in Table 3 show that the Tablet Granulation Sub-Division, Line I, at PT ABC experienced an unfavorable expenditure variance of Rp23,411,105,066, which, upon investigation, was found to be caused by depreciation costs for Class III machinery amounting to Rp22,884,950,014 that had not been previously budgeted for, plus a number of other actual cost components such as fees for temporary staff and annual incentives, which had also not been budgeted for. Conversely, all cost centers at PT DEF, which produces Captopril, showed a favorable expenditure variance, indicating better control over actual conversion costs compared to the budget for that period.

Table 4. Maximum Capacity and Budgeted Capacity for the Captopril Product Cost Center

Cost Center	Entity	Maximum Capacity	Budgeted Capacity
Tablet Granulation Sub-Section, Line I	ABC	14,412	7,206
Tablet Compression Sub-Section, Line I	ABC	36,030	18,015
Primary Packaging Sub-Section	ABC	68,452	34,226
Secondary Packaging Sub-Section	ABC	36,030	18,015
Final Mixing GPU	DEF	7,920	9,097
Tableting GPU	DEF	12,672	19,628
Packaging GPU	DEF	22,810	30,671

Source: Processed data

Based on this data, the standard conversion cost rate is calculated by dividing the budgeted conversion cost by the maximum capacity; the volume variance is then calculated by multiplying this rate by the difference between the maximum capacity and the budgeted capacity, as shown in Table 5.

Table 5. Standard Conversion Rates and Variations in Captopril Product Volume (F = Favorable, U = Unfavorable)

Cost Center	Entity	Standard Conversion Rates (Rp)	Varians Volume (Rp)
Tablet Granulation Sub-Section, Line I	ABC	1,098,219	7,913,767,316 U
Tablet Compression Sub-Section, Line I	ABC	667,473	12,024,532,350 U
Primary Packaging Sub-Section	ABC	653,725	22,374,391,265 U
Secondary Packaging Sub-Section	ABC	852,209	15,352,553,347 U
Final Mixing GPU	DEF	1,114,842	1,312,168,555 F
Tableting GPU	DEF	1,018,528	7,084,883,240 F
Packaging GPU	DEF	2,065,907	16,240,097,221 F

Source: Processed data

The results in Table 5 reveal an interesting pattern: all of PT ABC's cost centers have unfavorable volume variances, meaning that budgeted capacity is well below maximum capacity (utilized capacity is only around 50 percent of maximum capacity in most cost centers), while all of PT DEF's cost centers, conversely, experienced favorable volume variances, as the budgeted capacity had already exceeded the recorded maximum capacity, indicating the possibility that the maximum capacity figures were not up to date or that overtime and/or additional shifts were being utilized. This difference in capacity utilization patterns is one of the key findings relevant to the holding company's strategic decision-making regarding the allocation of production orders between entities and/or future production capacity investment planning, as discussed further. The Captopril case study in Stages 2 and 3 provides a concrete illustration of how the standardization approach formulated in this research is applied at the operational level, and serves as the methodological basis for the HPP simulation across all 41 other overlapping products, which are presented comprehensively in Stage 4.

4.1.4. Stage 4: Simulation of Cost of Goods Sold Calculations Based on Standard Costs

At this stage, a simulation of the cost of goods manufactured (COGM) calculation was carried out using the standard costs derived from the standardization of Stages 2 and 3, applied to all intersecting products, that is, products with the same active ingredient, dosage form and strength produced by both PT ABC and PT DEF, so that the COGM of the two entities could be compared on an equal footing (apple-to-apple). The simulation was carried out under two scenarios: the standard cost (budget) scenario and the actual cost scenario; the results were then compared with the existing COGM previously used by each entity. This stage resulted in the identification of 41 intersecting products, along with a comprehensive table comparing the simulated COGM with the existing COGM, as detailed below.

A. Simulated Products

A total of 41 overlapping products (following the consolidation of packaging variants) were identified as the subject of the simulation; these comprised various dosage forms (tablets, capsules, syrups, suspensions, creams, powders and powders for injection) within therapeutic groups including antibiotics,

antihypertensives, antidiabetics, analgesics and antipyretics, medicines under the national health program (Fixed Dose Combination for TB), and oral rehydration solutions.

Table 6. List of Intersecting Products of PT ABC and PT DEF

No.	Overlapping Product Names
1.	Acyclovir 200 mg Tablet
2.	Acyclovir 400 mg Tablet
3.	Acyclovir 5% Cream
4.	Albendazole 400 mg Chewable Tablet
5.	Albendazole (Orange Flavour)
6.	Ambroxol 15 mg/5 mL Syrup
7.	Ambroxol 30 mg Tablet
8.	Amlodipine 10 mg Tablet
9.	Amlodipine 5 mg Tablet
10.	Mefenamic Acid 500 mg Film-coated Capsule
11.	Captopril 12.5 mg Tablet
12.	Captopril 25 mg Tablet
13.	Cefadroxil Monohydrate 500 mg Capsule
14.	Cefixime 100 mg Capsule
15.	Chloramphenicol 250 mg Capsule
16.	Ciprofloxacin 500 mg Film-coated Tablet
17.	Clopidogrel Bisulphate 75 mg Film-coated Tablet
18.	Cotrimoxazole 240 mg/5 mL Suspension
19.	Cotrimoxazole 480 mg Tablet
20.	Ethambutol 400 mg Film-coated Tablet
21.	Glibenclamide 5 mg Kaptab
22.	Incephin 1 g Powder for Injection
23.	Indoralyte Powder
24.	Ketoconazole 5% Cream
25.	Meloxicam 7.5 mg Tablet
26.	Metamizole Sodium 500 mg Tablet
27.	Omeprazole 20 mg Capsule
28.	Oralit 200 Powder
29.	Paracetamol 120 mg/5 mL Syrup
30.	Paracetamol 500 mg Tablet
31.	Prednisone 5 mg Tablet
32.	Ranitidine 150 mg film-coated tablet
33.	Rifampicin 150 mg/Isoniazid 150 mg film-coated tablet (FDC 2) — 6 blister packs
34.	Rifampicin 150 mg/Isoniazid 150 mg film-coated tablet (FDC 2) — 7 blister packs
35.	Rifampicin 150 mg/Isoniazid 75 mg/Pyrazinamide 400 mg/Ethambutol 275 mg film-coated caplets (FDC 4)
36.	Rifampicin 75 mg/Isoniazid 50 mg (FDC 2 for children)
37.	Rifampicin 75 mg/Isoniazid 50 mg/Pyrazinamide 150 mg (FDC 3 for Children)
38.	Salbutamol 4 mg Tablet
39.	Sodium Diclofenac 50 mg Film-Coated Tablet
40.	Iron Supplement Tablet
41.	Zinc 20 mg Dispersible Tablet

Source: Processed data

The majority of these overlapping products are generic medicines and medicines used in national health programs (including the rifampicin-isoniazid combination for the tuberculosis control program and oral rehydration solution/oralit), the selling prices of which are regulated or heavily influenced by government procurement policies. This characteristic makes the accuracy of the cost of goods manufactured (COGM) for this product group highly relevant to decision-making regarding pricing and production allocation within the holding company, given that the scope for increasing selling prices is very limited; consequently, decisions

regarding which entity is most efficient at producing a particular item depend heavily on the accuracy of the available COGM information.

B. Comparison of Simulated Cost of Goods Manufactured with Existing Cost of Goods Manufactured

Table 7 below presents the complete results of a comparison between the unit cost of goods manufactured (COGM) from the simulation (based on standardized costs following standardization) and the existing unit COGM (based on each entity's method prior to standardization) at PT ABC (entity codes ABC UPJ/UPB/UPM/UPW according to plant unit) and PT DEF (entity code DEF), under both standard and actual conditions. The difference and percentage difference are calculated as (Simulated COGM, Existing COGM) divided by Existing COGM; a negative value indicates that the simulated COGM following standardization is lower than the existing COGM (more efficient), while a positive value indicates the opposite.

Table 7. Comparison of Simulated Cost of Goods Manufactured (COGM) Calculations with Existing COGM: PT ABC and PT DEF (per unit, in Rupiah)

Product	Entity	Std (Simulation)	Actual (Simulation)	Std (Existing)	Actual (Existing)	% Actual
Captopril 12.5 mg Tablet	ABC	89.79	126.82	134.92	200.11	37%
Captopril 12.5 mg Tablet	DEF	125.14	139.43	58.60	132.06	-6%
Amlodipine 10 mg Tablet	ABC	71.42	122.20	102.04	150.76	19%
Amlodipine 10 mg Tablet	DEF	166.91	232.56	82.77	266.17	13%
Glibenclamide 5 mg Kaptab	ABC	41.27	168.50	165.43	216.42	22%
Glibenclamide 5 mg Kaptab	DEF	94.01	107.82	54.29	141.27	24%
Omeprazole 20 mg Capsule	ABC	207.66	526.92	544.07	1,083.20	51%
Omeprazole 20 mg Capsule	DEF	358.98	362.64	208.47	606.19	40%
Iron Supplement Tablet	ABC	133.39	142.70	164.20	223.49	36%
Zinc 20 mg Dispersible Tablet	DEF	155.34	175.31	92.88	249.72	30%

Source: Processed data

Table 7 shows a pattern consistent with the author's findings across all 41 products. Under the actual cost scenario, the simulated standardized COGM is generally lower than the existing COGM at both PT ABC and PT DEF, with differences ranging from 13 percent to 51 percent; for example, Omeprazole 20 mg Capsule at PT ABC had an existing COGM of Rp1,083.20 per unit versus a simulated COGM of Rp526.92 per unit, 51 percent lower. The exception is Captopril 12.5 mg Tablet at PT DEF, whose simulated COGM is 6 percent higher, because a large favorable volume variance at its Cost Center, combined with a higher standard conversion rate than its existing practice, raised the standardized conversion cost per unit. More broadly, the simulation results vary between the two entities: for most products the standardized COGM is lower than existing, suggesting the existing methods tend to over-charge conversion costs relative to the unified standard allocation, while for a smaller set of products the standardized COGM is higher, pointing to cost components such as raw materials with significant price variances or low-utilization Cost Centers that the existing methods had not fully charged proportionally. Overall, these findings confirm that differing conversion cost allocation methods and assumptions between entities can produce material COGM disparities even for identical products, and that the standardization method developed in Stages 2 and 3 succeeds in creating a more equitable cost comparison basis while flagging products with cost inefficiencies relevant to the holding company's strategic decisions.

4.1.5. Stage 5: Analysis of ERP Implementation and Formulation of Recommendations

In this final stage, a descriptive analysis was carried out of the implementation status of the Enterprise Resource Planning (ERP) system across the three holding company entities: PT ABC, PT DEF, and PT IBU, through an examination of the system architecture, module scope, and maturity level of its use in supporting the calculation of cost of goods manufactured. Based on the results of this review, recommendations were formulated for technical adjustments at the system module level (for SAP-based entities) as well as recommendations for integration strategies at the organizational and holding company governance levels. This phase resulted in a mapping of the ERP status across the three entities, as well as two sets of recommendations, SAP module adjustments and institutional integration strategies, as outlined below. The success of the sustainable implementation of COGM standardization is highly dependent on the suitability of the information systems (ERP) used by each holding company entity.

A. Implementation of ERP at PT ABC

PT ABC has implemented an SAP-based ERP system comprising the Financial Accounting (FI), Controlling (CO), Material Management (MM), and Production Planning (PP) modules, all of which are fully integrated. The Controlling module enables standard cost calculations and variance analysis to be carried out automatically at the Cost Center and Cost Element levels, with costing runs based on the Bill of Materials and Master Recipe, which have been standardized within the company. The maturity of this ERP implementation has established PT ABC as a benchmark (best practice) for data structure in the formulation of standardized holding conversion costs.

B. ERP Implementation at PT DEF

PT DEF has implemented an ERP system covering accounting and production modules that functionally support standard cost calculations, albeit with a more streamlined Cost Center structure and lower level of data granularity compared to PT ABC. This difference in data structure presents one of the main challenges in the standardization process, as it requires the remapping of Cost Centers and cost elements to ensure they can be consistently aligned with PT ABC's data structure, as formulated in Stage 3.

C. ERP Implementation at PT IBU

As the holding company, PT IBU has implemented a Microsoft Dynamics AX-based ERP system that is integrated with a number of other operational support systems. Because the characteristics of biological/vaccine production processes differ fundamentally from the solid and liquid pharmaceutical production processes at PT ABC and PT DEF, PT IBU's Cost Center structure and conversion cost allocation scheme were not included in the COGM comparison simulation in Stage 4. Nevertheless, as the holding company, the readiness of PT IBU's ERP infrastructure remains a key consideration in designing the corporate-level cost data consolidation architecture.

4.1.6. Recommendations for SAP System Adjustments Based on the New COGM Formula

For PT ABC and PT DEF, which both use SAP-based ERP systems, the implementation of the COGM standardization formula formulated in Stages 2 and 3 requires technical adjustments to several SAP modules. The recommended adjustments are set out by module as follows.

A. Finance Module

To ensure that the cost of goods manufactured (COGM) for each entity can be consolidated at holding company level and that inter-entity reporting can be standardized, it is necessary to standardize the cost center coding across all company entities, so that COGM data from each cost center can be identified and consolidated automatically without the need for manual conversion.

B. Production Planning Module

Adjustments to the Production Planning module cover nine main areas: (1) Bill of Materials, adjustment of the composition of raw materials into three categories (API, excipient, packaging) in accordance with the new COGM formula; (2) Resources, adjustment of production scheduling, capacity planning, and costing for objects representing production work centers; (3) Standard Value Key, adjustments to activity parameters such as machinery and energy, depreciation and maintenance, and overheads, with units in hours; (4) Formulas, adjustments to the calculation formulas for costing, scheduling, and capacity requirement planning; (5) Cost

Center and Activity Type, allocation of all resources to Cost Centers and activity types in accordance with the new COGM formulation; (6) Master Recipe, adjustment of standard values (activities) forming the basis of the cost estimate; (7) Production Version, a combination of the Master Recipe and BOM to support COGM comparison simulations; (8) Process Order Creation, adjustments to the production scheduler and batch size to generate planned costs derived from the standardized BOM and Master Recipe; and (9) Process Order Execution, adjustments to the recording of three activities (goods issue, confirmation, and goods receipt) that automatically determine the actual cost.

C. Material Management Module

The adjustments to the Material Management module focus on Material Valuation using the moving average price method, with adjustments to the Accounting tab covering Price Determination (transaction-based), Price Control (moving average indicator), and Periodic Unit Price/Moving Price, in line with the recommended inventory valuation method for Phase 2.

D. Controlling Module

Adjustments to the Controlling module cover four areas: (1) the allocation of costs from indirect/supporting cost centers to direct production cost centers using the Assessment Allocation method, whereby costs are transferred via internal journal entries to secondary cost elements without removing the original cost source; (2) Cost Planning, standardization of Cost Center coding so that each entity's Production Planning module accommodates a uniform cost of goods manufactured (COGM) formula; (3) Cost Centers, adjustments to ensure that only Cost Centers directly involved in production are assigned to conversion cost calculations, while costs from non-production Cost Centers are allocated directly to production Cost Centers; and (4) Activity Type Planning, determining the rates for each production overhead component through four stages (cost planning in accordance with the Annual Work Plan per Cost Center, production hour plans per Cost Center, the cost allocation and splitting process, and the calculation of plan rates), which can be carried out manually or in accordance with SAP Best Practice, each with its own advantages and limitations.

Before full implementation, it is recommended that all the above adjustments be tested first using the Product Cost Simulation function in SAP, to verify that the cost of goods manufactured (COGM) calculations using the new formula are as expected before being used for official reporting. It should be noted that these technical recommendations apply to entities using the SAP platform (PT ABC and PT DEF); PT IBU, which uses Microsoft Dynamics AX and the Q100 application, requires a separate adjustment approach that is technically outside the scope of this study, as stated in the study's limitations. It is recommended that these five steps be implemented gradually but continuously (rather than as a one-off), with the fifth step (monitoring and updating standards) providing regular feedback to the second step (cost accounting policy), so that the COGM standardization guidelines remain relevant in line with changes to production processes, raw material prices, and the holding company's organizational structure. This recommended workflow is illustrated in Figure 2.

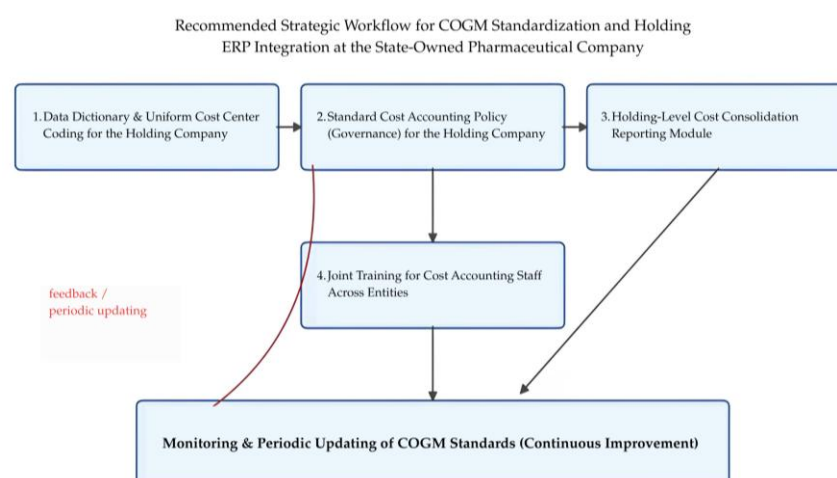


Figure 2. Recommended Strategic Workflow for COGM Standardization and ERP Integration within the State-Owned Pharmaceutical Holding Company

Source: Processed data

4.2. Discussions

4.2.1. Current Status of Cost of Goods Manufactured Calculations at PT ABC and PT DEF

The diagnostic findings indicate that, conceptually, both entities apply a standard cost approach with variance analysis; however, they differ significantly in three operational aspects: the scope of production costs (PT ABC includes management and factory administration labor costs within production costs, whereas PT DEF does not), cost classification (PT ABC uses two broad categories, material costs and activity costs, with an average composition of 65:35, while PT DEF uses three categories: materials, conversion costs, and support costs), and the format and depth of variance analysis (PT ABC at the Cost Center and Cost Element levels, while PT DEF uses nine standard variance accounts).

Consequently, the current situation indicates that the COGM of the two entities cannot, in essence, be compared on an equal footing (“apple to apple”), as the observed differences in COGM may reflect differences in accounting methods and the scope of costs, rather than solely differences in actual production efficiency. The findings in Table 1 (comparison of the current situation) provide empirical evidence of this discrepancy, while also serving as the primary justification for why the standardization of direct raw material costs and conversion costs (Stages 2 and 3) is required as a subsequent step in this study.

4.2.2. Design for the Standardization of Direct Raw Material Costs and Conversion Costs

Two concrete proposals: first, the standardization of raw material costs through the harmonization of classifications (API, excipient, packaging), a moving average based inventory valuation method, and a price quantity variance analysis format; second, the standardization of conversion costs through the mapping of Cost Centers to CCTL/CCL categories and activity levels, as well as a two stage allocation scheme accompanied by a format for analyzing expenditure variance and volume variance. The feasibility of both proposals was verified through a pilot test using real world data for the Captopril product across both entities. The results of the pilot test on raw material costs showed that the design successfully separated price variances and quantity variances clearly for each raw material item, including identifying the active ingredient in Captopril that experienced an unfavorable price variance due to a rise in procurement prices.

The results of the pilot test on conversion costs revealed more in depth findings, namely the uncovering of striking disparities in capacity utilization: all of PT ABC’s cost centers tested were operating well below maximum capacity (unfavorable volume variance), while all equivalent cost centers at PT DEF were operating at or above their maximum capacity (favorable volume variance). Consequently, the resulting standardization framework is not only uniform in format but has also proven capable of revealing substantive differences in resource utilization between entities that were previously unseen due to the lack of an equivalent basis for comparison.

4.2.3. Results of COGM Calculation Simulations for Overlapping Products

The findings indicate that, under the actual cost scenario, the majority of products across both entities have a simulated standardized COGM that is lower than the existing COGM, suggesting that the existing calculation method for a number of products tends to allocate a higher proportion of conversion costs compared to the results of allocation using the standardized method. For a small proportion of other products, the opposite pattern occurs, indicating that certain cost components had not previously been allocated proportionately under each entity’s existing method.

Overall, the simulation results answer the third research question by confirming that differences in conversion cost allocation methods and assumptions between entities can result in material COGM disparities, even for products with identical formulations and dosage forms. Consequently, the standardization of COGM calculation methods has proven capable of producing a more equitable basis for cost comparison between entities, while specifically identifying which overlapping products harbor potential cost inefficiencies and require the holding company’s management attention, information that would not be obtainable if the COGM of both entities continued to be calculated using their respective, non-standardized methods.

4.2.4. The Status of ERP Implementation and Integration Strategies

The results of Stage 5 revealed that PT ABC has a relatively higher level of maturity in the implementation of its SAP-based ERP system; PT DEF utilizes the SAP platform with a more concise level of data granularity; while PT IBU employs a completely different platform (Microsoft Dynamics AX and Q100), which is in line with the unique characteristics of its biological/vaccine production.

Based on this mapping, this study formulates a two tier integration strategy in response to the second part of the fourth research question: the technical tier, comprising specific adjustments to four SAP modules (Finance, Production Planning, Material Management, and Controlling) for SAP based entities; and an institutional layer, comprising five integration strategy steps (data dictionary, cost accounting policies, consolidation reporting module, staff training, and periodic monitoring) applicable to all entities, including PT IBU, as illustrated in Figure 2. Thus, differences in ERP platforms between entities do not pose an obstacle to the consolidation of COGM data, provided that both layers of the strategy are implemented consistently.

4.2.5. The Contribution of COGM Standardization to Strategic Decision Making within the Holding Company

The results of the analysis indicate that the disparity in COGM between PT ABC and PT DEF for overlapping products is largely attributable to differences in the methods and structure of conversion cost allocation, rather than to actual differences in the efficiency of raw material utilization or production processes. This finding is consistent with the theoretical review in Chapter II, which states that the quality of managerial decisions, particularly strategic decisions that have significant impact and are difficult to rectify, is highly dependent on the reliability and comparability of the underlying cost information (Horngren et al., 2006); without standardization, the holding company's management risks drawing erroneous conclusions regarding which entity is actually more efficient, solely due to differences in accounting methods rather than differences in actual performance.

With the implementation of standardization of direct raw material costs and conversion costs (Stages 2 and 3), the pharmaceutical holding company has a more comparable (apple to apple) cost of goods manufactured (COGM) information base to support four types of strategic decisions: (1) more accurate long term pricing policy decisions, as these reflect a mutually agreed standard cost structure, particularly for national health program products where scope for price increases is limited; (2) objective evaluation of production unit performance across entities through variance analysis using a standardized format, as the basis for determining centers of excellence; (3) identification of entities or production units with best practice cost management that can be replicated across other entities; and (4) a basis for considering investment allocation or the consolidation of production capacity for overlapping products.

Furthermore, the ERP integration strategy formulated in Stage 5 ensures that standardized COGM information is available on an ongoing and timely basis, rather than merely as the result of a one off study, so that it can continue to be relied upon as input for the holding company's strategic decision making over time. The findings regarding disparities in production capacity utilization between PT ABC and PT DEF in the Captopril case study provide the most concrete illustration of this added value: while capacity at several of PT ABC's cost centers was recorded as being well below maximum capacity, similar cost centers at PT DEF were operating at or above their maximum capacity; this information, if consistently available and comparable at holding company level, can form the basis for management's consideration in relocating production orders between entities, planning capacity expansion investments, or even evaluating the consolidation of specific production lines. Without standardization of the reporting formats for capacity and conversion costs, such strategic decisions would be difficult to make accurately, as data from the two entities cannot be directly compared and risks being misinterpreted.

Thus, the answer to the fifth research question confirms that the benefits of COGM standardization are not limited to the accuracy of cost recording alone, but extend to the quality of the holding company's strategic decision making as a whole, in line with the concept of the "parenting advantage" in holding company theory, which emphasizes the active role of the holding company in creating added value for its subsidiaries. To summarize the relationship between the research findings and the types of strategic decisions supported, Table 8 below maps each key finding from Stage 1 to Stage 5 against the research question it answers and the relevant type of holding company decision.

Table 8. Mapping of Research Findings against Types of Managerial Decisions within the Holding Company

Research Findings	Types of Decisions Supported
Disparities in scope and cost classification between entities	Standard cost accounting policy for the holding company
Price and quantity variances for Captopril raw materials	Procurement and quality control policy for raw materials
Expenditure and volume variances for Captopril conversion costs	Performance evaluation of production units and capacity planning
Comparison of simulated COGM versus actual COGM for 41 products	Setting of selling prices and identification of best practice
Status and gaps in ERP implementation	Investment strategy and integration of the holding company's information systems

Source: Processed data

5. CONCLUSIONS

The research findings indicate that, although PT ABC and PT DEF have broadly similar cost classifications, there are still differences in the scope of production costs, cost center structure, overhead cost allocation methods, and variance analysis; consequently, the cost of goods manufactured (COGM) calculations for the two entities cannot yet be compared on an equal footing. This study successfully formulated a standardization of raw material costs through the harmonization of raw material classifications, a moving average based inventory valuation method, and a consistent variance analysis. Standardization was also applied to conversion costs through cost center mapping, a two stage cost allocation scheme, and a variance analysis capable of identifying differences in the utilization of production capacity between the entities.

Simulations on 41 products showed that the standardized COGM differed materially from the existing COGM, indicating that the method of calculating conversion costs also influences the reported COGM. Furthermore, differences in the maturity of ERP implementation between PT ABC, PT DEF, and PT IBU require a structured data integration strategy. Overall, COGM standardization has proven capable of providing more reliable and comparable cost information, thereby supporting decision making regarding pricing, performance evaluation, the identification of best practices, and capacity and investment planning at the holding company level.

This study recommends that the management of the pharmaceutical holding company establish COGM standardization guidelines as a cost accounting policy applicable to all entities, accompanied by mechanisms for periodic evaluation and updating. From an information systems perspective, it is necessary to harmonize the data dictionary and Cost Center codes, develop an integrated cost reporting module at the holding company level, and carry out simulations prior to full implementation within the ERP system. From an institutional perspective, enhancing human resource competencies through joint training and extending standardization to PT IBU, taking into account the differing characteristics of production processes and ERP platforms, are also recommended steps.

This research provides theoretical implications by enriching the study of management accounting regarding the application of standard costs and variance analysis in cross entity cost standardization within a holding structure, while demonstrating that cost synergies can be realized through cost accounting instruments. From a practical perspective, this study produces guidelines for cost standardization that can be adopted as company policy, assist in evaluating the utilization of production capacity, and serve as a reference for other pharmaceutical holding companies wishing to implement cost standardization.

This study is limited by its use of single period data, a simulation scope confined to products shared between PT ABC and PT DEF, and the absence of both an analysis of standardization's impact on the holding company's consolidated profit performance and a post implementation evaluation. Future research is therefore encouraged to examine this impact longitudinally, extend the simulation to the full product portfolio including biologics and vaccines, and apply an action research approach to assess the standardization guidelines' effectiveness in practice.

6. REFERENCES

- Anthony, R. N., & Govindarajan, V. (2007). *Management Control Systems* (12th ed.). McGraw-Hill/Irwin.
- Asharudin, D., & Sululing, S. (2018). Analisis Harga Pokok Penjualan Pada Laba Di Apotik Kimia Farma No. 66 Luwuk. *Jurnal Ekonomi*, 21(1), 23. <https://doi.org/10.24912/je.v21i1.380>
- Ficbauer, D., & Režňáková, M. (2014). Holding company and its performance. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, 62(2), 329–337. <https://doi.org/10.11118/actaun201462020329>
- Garrison, R. H., Noreen, E. W., Brewer, P. C., & McGowan, A. (2010). Managerial Accounting. *Issues in Accounting Education*, 25(4), 792–793. <https://doi.org/10.2308/iace.2010.25.4.792>
- Horngren, C. T., Datar, S. M., & Foster, G. (2006). *Cost Accounting: A Managerial Emphasis*. Pearson Prentice Hall.
- Horngren, C. T., Foster, G., Datar, S. M., Rajan, M., Ittner, C., & Baldwin, A. A. (2010). Cost Accounting: A Managerial Emphasis,. *Issues in Accounting Education*, 25(4), 789–790. <https://doi.org/10.2308/iace.2010.25.4.789>
- Mowen, M., & Hansen, D. R. (2017). Cornerstones of cost management. *United State of America: Cengage Learning*.
- Mulyadi. (2014). *Akuntansi biaya*. BPFE-Yogyakarta.
- Porter, M. E. (2008). *Competitive Advantage: Creating And Sustaining Superior Performance*. Simon and Schuster.
- Rahmasania, H., & Dahtiah, N. (2022). Analisis Penerapan Target Costing dan Activity Based Costing Sebagai Alternatif Pengendalian Harga Pokok Produksi. *Jurnal Riset Akuntansi Dan Keuangan*, 10(2), 209–220. <https://doi.org/10.17509/jrak.v10i2.38531>
- Risnarningsih, R., Putri, S. A., & Wea, Y. E. (2023). Dampak Biaya Produksi, Harga Jual, dan Volume Penjualan Terhadap Laba Bersih pada Perusahaan Farmasi. *Journal of Indonesian Economic Research*, 1(1), 41–48. <https://doi.org/10.61105/jier.v1i1.29>
- Romney, M. B., & Steinbart, P. J. (2018). *Accounting Information Systems* (4th Ed). Pearson.
- Tahir, A., Auliyah, I., Lande, A., & Basannang, S. M. (2026). Optimizing production cost through activity-based costing approach as a strategy to increase company profit. *Jurnal Economic Resource*, 9(1), 280–294.