

Article

Improving Cost Accounting and Financial Performance Measurement in Pulp and Paper Manufacturing Enterprises

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Abstract: This study examines theoretical and methodological approaches to product cost determination, production cost accounting, and financial performance measurement in pulp and paper manufacturing enterprises. Particular attention is given to the multistage nature of production, raw material consumption, technological losses, energy utilization, and the allocation of manufacturing overheads among different product categories. The study explores the applicability of process costing and standard costing and proposes an integrated approach to cost classification, responsibility-center accounting, and financial performance analysis. The methodological framework draws on relevant accounting regulations of the Republic of Uzbekistan and International Financial Reporting Standards, particularly IAS 2, *Inventories*. A conceptual model is developed to link production processes, cost accumulation, finished goods valuation, and financial results. The findings suggest that process-based analytical accounting, resource-consumption standards, systematic variance analysis, and more appropriate overhead allocation bases can improve cost information reliability and strengthen managerial control. The numerical example is illustrative and does not represent verified financial data from an actual enterprise. The proposed approach may provide a methodological basis for improving cost management, inventory valuation, and profitability analysis in pulp and paper manufacturing.

Keywords: product costing, pulp and paper industry, production costs, process costing, standard costing, financial performance.

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1. Introduction

Accurate product costing and reliable financial performance measurement are essential conditions for improving the economic efficiency of industrial enterprises. These issues are particularly important in pulp and paper manufacturing, where multistage processing, substantial water and energy consumption, equipment depreciation, technological waste, and product quality requirements create specific challenges for cost accounting [1].

The principal production inputs in this industry include pulp, recovered paper, chemical reagents, water, and energy resources. Changes in raw material quality and production technology can affect resource consumption per unit of output and, consequently, manufacturing costs and profitability. Therefore, recording total expenditure alone is insufficient. Costs should also be analyzed according to their causes, production stages, responsibility centers, and product categories [2].

In Uzbekistan, National Accounting Standard No. 4, *Inventories*, provides an important regulatory framework for inventory accounting and valuation. Internationally,

International Accounting Standard (IAS) 2, *Inventories*, establishes principles for determining inventory cost, including relevant purchase and conversion costs and other costs incurred in bringing inventories to their present location and condition [3].

The objective of this study is to develop theoretical and methodological recommendations for improving product cost accounting and financial performance measurement in pulp and paper manufacturing enterprises.

The research objectives are to examine the economic nature of production costs, assess costing methods suitable for the industry, explain the accounting relationship between product costs and financial results, and formulate practical recommendations for strengthening cost control and management accounting.

The research object is the process of accounting for production costs and determining financial results in pulp and paper manufacturing enterprises. The research subject comprises the economic relationships and methodological approaches associated with product costing, cost allocation, and the recognition of financial results.

Product costing and cost management constitute important areas of management accounting research. Horngren, Datar, and Rajan discuss the assignment of costs to products, services, and other cost objects, emphasizing the role of cost information in managerial decision-making. Their approach supports the need to analyze costs not only by accounting category but also by production stage and product type [4], [5].

Drury examines management and cost accounting in relation to planning, control, performance evaluation, and decision-making. These concepts provide a theoretical basis for comparing actual costs with predetermined standards, identifying variances, and investigating their underlying causes.

IAS 2 specifies the principles governing inventory cost measurement, the treatment of conversion costs, and the recognition of inventory carrying amounts as expenses when the related inventories are sold.² It also addresses the systematic allocation of fixed and variable production overheads and requires inventories to be measured at the lower of cost and net realizable value. These requirements are relevant to the valuation of finished paper products and work in progress.

Uzbekistan's National Accounting Standard No. 4, *Inventories*, provides a domestic regulatory reference for inventory accounting.¹ In continuous or sequential manufacturing processes, process costing can be used to accumulate costs by production stage. Standard costing can complement this approach by establishing resource-consumption standards and identifying deviations between planned and actual costs.

The literature indicates that general principles of cost accounting are well established. However, their application to the specific technological conditions of pulp and paper manufacturing requires further methodological development. Particular issues include the separate recording of technological losses, the treatment of recoverable waste, the allocation of energy costs across production stages, and the integration of cost information with financial performance measurement.

The present study addresses these issues through a conceptual framework linking production-stage cost accumulation, inventory valuation, and financial results. Its contribution is methodological rather than an empirically verified estimate of cost savings or profitability improvements [6].

2. Materials and Methods

The study employs a systems approach, economic analysis, comparison, classification, costing, logical generalization, and process-based analysis. Its regulatory and theoretical foundation consists of relevant accounting requirements of the Republic of Uzbekistan and international financial reporting standards relating to inventories and financial statements.

For analytical purposes, the manufacturing process is divided into the following stages: raw material preparation, pulp or stock preparation, paper web formation, drying, finishing and cutting, and packaging. At each stage, material consumption, labor costs, energy expenditure, and manufacturing overheads should be identified and analyzed.

The general formula for calculating the unit production cost is:

$$T = \text{WIP}_b + C_p - \text{WIP}_e / Q$$

where:

T = production cost per unit of finished output;

WIP_b = opening work-in-progress inventory;

C_p = production costs incurred during the reporting period;

WIP_e = closing work-in-progress inventory;

Q = quantity of finished output produced during the period.

The formula should be applied to a clearly defined costing object and a consistent unit of measurement. Where products differ substantially in grade, technical characteristics, or processing requirements, separate cost calculations should be prepared for the relevant product categories.

The proposed model has not been empirically tested using verified accounting records from the enterprise discussed in the numerical illustration. Accordingly, the financial figures presented below are illustrative and should not be interpreted as independently verified company data.

3. Results

The first area for improving cost accounting in pulp and paper manufacturing is the classification of expenditure by economic nature and place of occurrence. Raw materials, auxiliary materials, production labor, energy resources, equipment depreciation, and other manufacturing overheads should be separately identified and allocated using appropriate accounting procedures [7].

Table 1. Classification of production costs and recommended accounting approaches in pulp and paper manufacturing

Cost category	Main components	Recommended accounting approach
Direct materials	Pulp, recovered paper, chemical reagents	By product category and production stage
Energy costs	Electricity, heat, water	Based on meter readings and consumption standards
Labor costs	Production wages and related employment costs	By department, process, and labor time
Depreciation	Production machinery and relevant fixed assets	By equipment group or production center
Manufacturing overheads	Repairs, maintenance, production supervision	Using an economically justified allocation base
Technological losses	Normal losses and abnormal losses	By cause and responsibility center

Source: Developed by the author based on references 1–3.

Separate analytical accounting for each production stage can help establish the relationship between resource consumption and finished output. It can also improve the identification of cost variances and their operational causes.

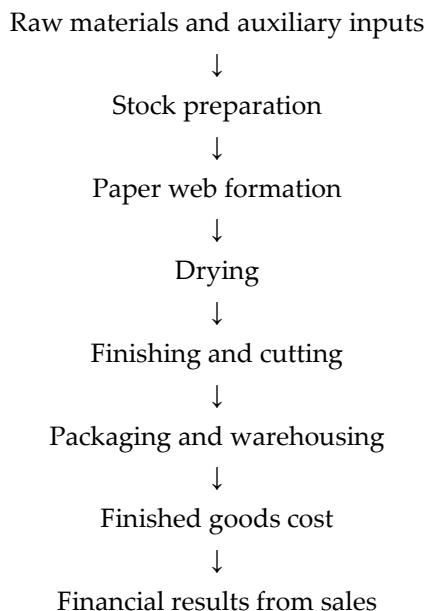


Figure 1. Conceptual model of cost formation in pulp and paper manufacturing

The model illustrates how production costs accumulate through successive manufacturing stages. For example, if energy consumption during drying exceeds the established standard, the variance should be separately analyzed as a potential driver of higher production costs [8].

Combining process costing with standard costing is appropriate for enterprises that manufacture large volumes of homogeneous or similar products through sequential technological operations. Process costing accumulates expenditure by production stage, whereas standard costing supports comparisons between predetermined resource-consumption standards and actual performance.

Table 2. Illustrative calculation model for product cost management at GLOBAL KOMSCO DAEWOO LLC, 2026

Indicator	Value (UZS)
Opening-period indicator, nature to be verified	200 000,00
Production costs incurred during the reporting period	1821483, 00
Manufacturing cost of finished products	1834027,04
Difference between reported production costs and finished-product manufacturing cost	12,544.04

Source: Author's calculations based on figures supplied for the study. The economic classification of the opening-period indicator and the accounting reconciliation require verification.

The difference between the reported manufacturing cost of finished products and production costs incurred during the period is calculated as follows.

This difference cannot automatically be interpreted as an accounting error or an additional cost. Its explanation depends on the opening and closing work-in-progress balances, inventory movements, cost adjustments, and the accounting classification of the reported figures [9], [10].

The unit production cost cannot be reliably calculated from the available information because the quantity of finished output has not been provided. In addition, the figure of UZS 200,000 must be identified as a specific accounting indicator before it can be incorporated into the costing formula.

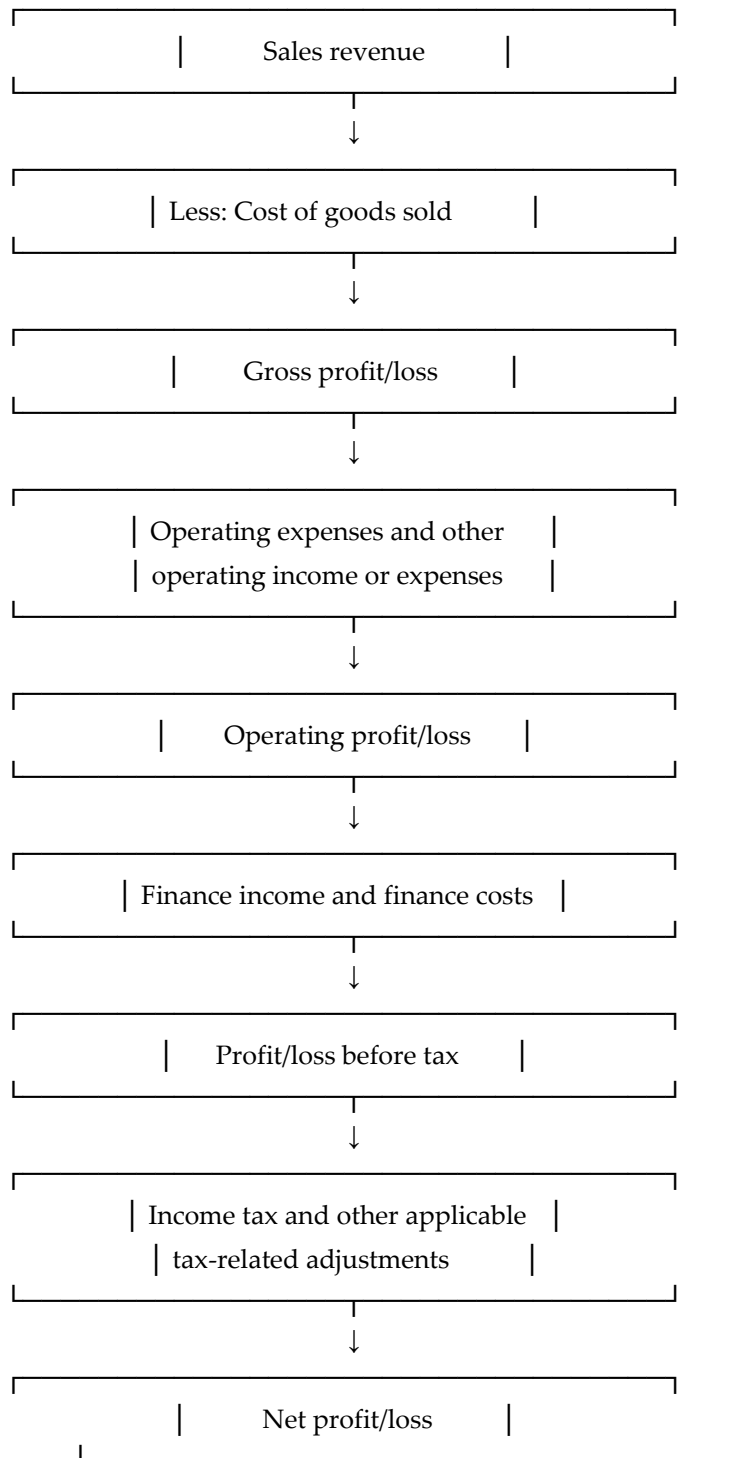


Figure 2. Relationship between product costing and financial performance measurement

The model illustrates the relationship between product costing and financial performance. Reliable measurement of the cost of goods sold is necessary for the appropriate determination of gross profit. Production cost must be distinguished from the cost of goods sold because finished products that remain unsold at the reporting date may continue to be recognized as inventory, subject to the applicable accounting requirements.

4. Discussion

The findings suggest that improving cost accounting in pulp and paper manufacturing should extend beyond the organization of bookkeeping entries and become integrated with production management. Recording costs by technological stage and responsibility center can support resource-efficiency analysis, the identification of excessive consumption, and more informed managerial decisions.

First, manufacturing overheads should be allocated using economically justified cost drivers. Allocating all energy expenditure solely according to total production tonnage may produce misleading results when production stages differ considerably in energy intensity. Where feasible, electricity and heat meters, machine hours, processing time, or other relevant measures should be used [11].

Second, technological losses should be classified as normal or abnormal. Normal losses may arise from the inherent characteristics of the manufacturing process. Abnormal losses may be associated with raw material quality, equipment condition, operational inefficiencies, or weaknesses in production organization. Their separate identification facilitates investigation of cost overruns and the assignment of responsibility.

Third, financial accounting and management accounting should be coordinated through consistent analytical records [12], [13]. Financial accounting provides information under the applicable reporting framework, whereas management accounting can supply more detailed data by product category, production department, order, and technological stage. Integrating these information systems can improve consistency and strengthen internal cost control.

Fourth, inventory valuation should reflect the applicable accounting framework. Under IAS 2, inventories are measured at the lower of cost and net realizable value. This principle is relevant when selling prices decline or products become damaged or obsolete, helping prevent inventory from being carried at an amount exceeding its recoverable selling value [14], [15].

Based on the analysis, the following methodological improvements are recommended:

- Establish separate analytical cost records for each significant production stage.
- Define and periodically update standards for raw materials, energy, and labor consumption.
- Allocate manufacturing overheads using cost drivers that reflect the underlying consumption of resources.
- Record and analyze normal and abnormal technological losses separately.
- Compare actual costs with planned or standard costs and investigate material variances.
- Distinguish the cost of finished production from the cost of goods sold.
- Link cost information to profitability, financial performance, and cash flow analysis.

These measures may help identify opportunities to improve resource utilization and control expenditure [16], [17]. However, their actual economic effects must be evaluated using verified enterprise data, taking account of production capacity, product mix, technology, quality requirements, and the reliability of accounting information.

The main limitation of this study is the absence of a complete, verified enterprise-level dataset. The proposed framework is therefore conceptual and methodological. Its practical effectiveness and quantitative impact on product cost and profitability require further empirical testing [18].

5. Conclusion

Improving product cost accounting and financial performance measurement is important for enhancing production efficiency, financial discipline, and managerial decision-making in pulp and paper manufacturing enterprises. The study supports the

following conclusions. First, because production involves multiple technological stages, costs should be recorded not only by general economic category but also by production process, product type, and responsibility center. Second, combining process costing with standard costing can improve cost determination and facilitate the identification of resource-consumption variances. Particular attention should be paid to recoverable waste, technological losses, and work-in-progress valuation. Third, allocating manufacturing overheads using energy consumption, machine hours, and other economically justified cost drivers can improve the reliability of product cost calculations. Fourth, integrating product cost accounting with financial performance measurement requires a clear distinction between the cost of production, the cost of goods sold, gross profit, operating profit, and net profit. Fifth, aligning accounting policies with applicable national regulations and relevant international reporting standards, while improving the digitalization of management accounting, can strengthen the reliability and timeliness of cost information. Overall, the proposed methodological framework provides a basis for strengthening cost control, improving product cost measurement, and supporting reliable financial performance analysis in pulp and paper manufacturing enterprises. Future research should apply the framework to verified production and financial records, test the proposed costing procedures in practice, and quantify their effects on cost efficiency and profitability.

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