# MATERIAL LOSS CONTROL IN VIETNAM'S CEMENT ENTERPRISES: A RESPONSIBILITY ACCOUNTING APPROACH

**Nguyen Thuy Linh***

**Abstract:** ***In Vietnam, cement production is among the most material-intensive manufacturing activities, operating under narrow cost margins and increasing pressure for operational efficiency. Material loss arising throughout the production process represents a significant but often under-recognized source of avoidable cost. From a responsibility accounting perspective, this study examines how material loss can be systematically identified, measured, and controlled through clearly defined responsibility centers in cement enterprises.***

***Using an integrated qualitative–quantitative approach, the study develops a responsibility-based analytical framework and illustrates its application through an illustrative case study based on internal material consumption data from a Vietnamese cement enterprise. Material loss is measured by comparing standard material consumption norms with actual consumption across major production responsibility centers, and loss variances are analyzed in both physical and monetary terms.***

***The findings indicate that incorporating material loss indicators such as loss rates and loss costs per unit of output into responsibility accounting reports improves cost transparency, strengthens managerial accountability, and enhances internal cost control effectiveness. By transforming material loss from an aggregated residual cost into a responsibility-based performance indicator, the study demonstrates the practical usefulness of responsibility accounting in material-intensive manufacturing environments.***

***This study contributes to applied management accounting literature by providing industry-specific evidence from Vietnam's cement sector and offering practical insights for managers seeking to improve resource efficiency and responsibility-based cost control.***

• Keywords: *responsibility accounting; material loss; cost control; cement enterprises; Vietnam.*

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## 1. Introduction

The cement industry plays a strategic role in Vietnam's socio-economic development by supplying essential materials for infrastructure construction and urbanization. Despite its importance, cement production is highly resource-intensive, requiring large quantities of limestone, clay, gypsum, and various additives. In recent years, rising input prices, increasing competitive pressure, and stricter efficiency requirements have intensified the need for effective cost control in cement enterprises (Ministry of Construction, 2021; VNCA, 2022).

Material loss generated during production through spillage, dust emissions, process inefficiencies, and deviations from technical norms constitutes a significant component of production costs in cement enterprises. When such losses are not explicitly measured, they are often absorbed into total material costs and escape managerial attention. As a result, material loss is frequently perceived as an unavoidable technical consequence rather than a controllable managerial issue (Drury, 2018).

Responsibility accounting, as a core component of management accounting, offers a suitable framework to address this limitation by assigning costs and performance outcomes to responsibility centers and evaluating managers based on controllable factors (Anthony & Govindarajan, 2007). In the context of Vietnamese enterprises, responsibility accounting has been recognized as an effective tool for strengthening internal cost control and managerial accountability (Nguyen, 2017; Pham, 2019).

## 2. Literature review and theoretical framework

### *2.1. Material Loss and Cost Control in Manufacturing*

Material loss refers to the portion of input materials that fails to be transformed into saleable

* *Hong Duc University, Thanh Hoa province; email: nguyenthuylinhkt@hdu.edu.vn*

output and therefore does not generate economic value (Horngren et al., 2021). In manufacturing industries, material loss directly affects production efficiency, unit costs, and competitive performance, making its identification and control a core task of management accounting (Drury, 2018).

In material- and energy-intensive industries such as cement manufacturing, material loss is closely associated with bulk material handling, continuous high-temperature processing, and dust-intensive operations. Prior studies applying material flow cost accounting emphasize that measuring material losses in both physical and monetary terms can improve cost transparency and supports operational efficiency improvements (ISO, 2011). However, without an appropriate responsibility accounting structure, such information often remains aggregated and provides limited support for managerial accountability.

### *2.2. Responsibility Accounting*

Responsibility accounting is a management accounting system that classifies organizational units into responsibility centers such as cost centers, profit centers, and investment centers and assigns accountability for costs and revenues to managers who have control over them (Anthony & Govindarajan, 2007).

A central principle of responsibility accounting is controllability, which requires that managers be evaluated only on costs and outcomes they can influence. Applying this principle to material loss management involves distinguishing between controllable and uncontrollable losses and allocating controllable losses to relevant responsibility centers (Drury, 2018). This approach transforms material loss from an aggregated residual cost into a measurable performance indicator reflecting managerial effectiveness in resource utilization.

### *2.3. Analytical Framework for the Cement Industry*

Cement manufacturing is characterized by a relatively standardized production process, which allows responsibility centers to be clearly identified for major stages such as raw material preparation, clinker production, cement grinding, and packaging. Each stage exhibits distinct types and levels of material loss, providing a suitable basis for responsibility-based analysis and cost control in cement manufacturing enterprises (Dang, 2016; Tran & Nguyen, 2020).

## 3. Research methodology

This study adopts an integrated qualitative–quantitative research design. Qualitatively, prior academic literature, industry reports, and relevant accounting regulations are synthesized to develop a responsibility accounting framework for material loss control in cement enterprises. Quantitatively, an illustrative case study is employed using internal material consumption data from a representative Vietnamese cement enterprise.

Material loss is measured by comparing standard material consumption norms with actual consumption at selected production stages. Loss variances are calculated and assigned to responsibility centers to demonstrate how responsibility accounting information can support internal cost control and managerial performance evaluation. The illustrative case study approach is adopted to demonstrate the applicability of responsibility accounting to material loss control rather than to generalize statistical relationships across the cement industry.

## 4. Material loss control in vietnam's cement industry: evidence from an illustrative case study

### *4.1. Production Output and Standard Material Norms*

Before analyzing material loss variances, it is necessary to clarify the production scale and technical material norms that constitute the baseline for responsibility accounting analysis. Table 1 summarizes key production outputs and standard material consumption norms applied by the case enterprise in 2024. These standards serve as the technical and managerial reference points for evaluating material loss and assigning responsibility. These standard material norms were officially approved and consistently applied throughout the fiscal year 2024.

**Table 1. Production Output and Standard Material Norms (2024)**

| Indicator | Unit | Value |
|---|---|---|
| Cement output | tons/year | 1,420,000 |
| Clinker output | tons/year | 1,050,000 |
| Standard limestone consumption | kg/ton clinker | 1,250 |
| Standard clay & additives | kg/ton clinker | 300 |
| Standard gypsum & additives | kg/ton cement | 50 |

*Source: Compiled by the author from technical norms and internal planning documents of the case enterprise.*

### *4.2. Case Description and Responsibility Structure*

The illustrative case study is based on a medium-sized cement enterprise in Northern Vietnam operating a dry-process production line. The enterprise applies a functional organizational structure in which major production stages are treated as cost responsibility centers in accordance with responsibility accounting principles (Anthony & Govindarajan, 2007).

For analytical purposes, three key production responsibility centers are examined: raw material preparation, clinker production, and cement grinding and packaging. These stages represent the most material-intensive processes in cement manufacturing and are the primary sources of material loss. Data used in the analysis were collected from internal material consumption reports, technical norms, and production records for the fiscal year 2024. To ensure confidentiality, the enterprise's name and specific commercial information are not disclosed.

### *4.3. Measurement of Material Loss by Responsibility Center*

Material loss is measured by comparing actual material consumption with standard consumption norms established by the enterprise based on technical specifications and internal planning documents. The difference between actual and standard consumption is treated as material loss variance and analyzed at the level of individual responsibility centers.

Table 2 presents a comparison between standard and actual material consumption per ton of output at selected production stages.

**Table 2. Material Loss by Responsibility Center**

| Responsibility center | Standard consumption (kg/ton clinker) | Actual consumption (kg/ton) | Loss variance (kg/ton) | Loss rate (%) |
|---|---|---|---|---|
| Raw material preparation | 1,550 | 1,580 | +30 | 1.94 |
| Clinker production | 1,020 | 1,065 | +45 | 4.41 |
| Cement grinding & packaging | 1,030 | 1,050 | +20 | 1.94 |

*Source: Compiled by the author from internal material consumption records of the case enterprise.*

The results indicate that actual material consumption exceeds standard norms in all three responsibility centers, confirming the existence of potentially avoidable material loss. Notably, the clinker production center records the highest material loss variance, reflecting the characteristics of high-temperature processing, continuous operation, and significant dust generation. In contrast, material loss rates in raw material preparation and cement grinding and packaging are lower and relatively similar.

### *4.4. Monetary Valuation of Material Loss from a Responsibility Accounting Perspective*

To enhance the usefulness of material loss information for managerial decision-making and responsibility evaluation, physical material loss is converted into monetary terms using the average material cost applicable to each production stage. This conversion allows material loss to be explicitly recognized as a controllable production cost rather than being implicitly embedded within total material expenses.

Table 3 presents the monetary valuation of material loss by responsibility center. Average material costs differ across responsibility centers due to variations in material composition, processing intensity, and the inclusion of semi-finished products and energy-related material inputs.

**Table 3. Monetary Valuation of Material Loss by Responsibility Center**

| Responsibility center | Loss (kg/ton) | Average material cost (VND/kg) | Loss cost (VND/ton) | Share (%) |
|---|---|---|---|---|
| Raw material preparation | 30 | 520 | 15,600 | 27.4 |
| Clinker production | 45 | 650 | 29,250 | 51.5 |
| Cement grinding & packaging | 20 | 600 | 12,000 | 21.1 |
| **Total** | **95** | | **56,850** | **100.0** |

*Source: Compiled by the author from internal accounting and cost data of the case enterprise.*

The results show that clinker production accounts for more than half of total material loss costs, identifying it as the most critical responsibility center for material loss control and cost management.

### *4.5. Responsibility-Based Performance Implications*

The responsibility-based valuation in Table 3 reveals that more than half of total material loss costs originate from the clinker production center, indicating a high potential for managerial intervention at this stage. To further strengthen the link between material loss and managerial accountability, Table 4 summarizes key responsibility-based performance indicators and corresponding management implications.

**Table 4. Responsibility-Based Performance Indicators**

| Responsibility center | Loss rate (%) | Degree of managerial controllability | Management implication |
|---|---|---|---|
| Raw material preparation | 1.94 | High | Improve material handling and weighing control |
| Clinker production | 4.41 | Medium–High | Stabilize kiln operation and enhance dust recovery |
| Cement grinding & packaging | 1.94 | High | Optimize grinding efficiency |

*Source: Developed by the author based on responsibility accounting analysis.*

The case study demonstrates that when material loss is measured and reported by responsibility center, it becomes a meaningful performance indicator within the responsibility accounting system. Instead of being treated as an unavoidable technical outcome, material loss is transformed into a controllable cost element that reflects managerial effectiveness.

Integrating material loss indicators such as loss rate, loss cost per ton of output, and total loss cost into responsibility reports strengthens internal cost control mechanisms and improves performance evaluation practices in cement enterprises.

## 5. Responsibility accounting and cost control implications

### *5.1. Responsibility Reporting for Material Loss*

Responsibility reports should incorporate both physical and monetary indicators of material loss, including loss rates, loss values per ton of output, and total loss costs by responsibility center. Such information supports timely monitoring and facilitates corrective managerial actions.

### *5.2. Performance Evaluation and Managerial Implications*

Integrating material loss indicators into performance evaluation systems enhances managerial accountability and aligns individual incentives with enterprise-wide cost control objectives. This finding is consistent with both international management accounting theory (Horngren et al., 2021) and empirical evidence from Vietnamese enterprises (Pham Quang Huy, 2019).

## 6. Discussion

The findings from the illustrative case study confirm the practical applicability of responsibility accounting in controlling material loss in Vietnam's cement industry. By explicitly identifying and assigning material loss to responsibility centers, enterprises can improve cost transparency and strengthen internal cost control. This approach is particularly relevant for Vietnamese cement enterprises operating under increasing cost pressure and efficiency requirements.

## 7. Conclusion and implications

This study analyzes material loss and cost control in Vietnam's cement industry from a responsibility accounting perspective. The results indicate that responsibility accounting provides an effective framework for identifying, measuring, and controlling material loss, thereby enhancing internal cost management and managerial accountability. Based on these findings, Vietnamese cement enterprises should formally incorporate material loss indicators into responsibility accounting reports to improve cost control efficiency. These findings also provide useful references for accounting practice and managerial decision-making in material-intensive manufacturing industries in Vietnam.

From a practical standpoint, cement enterprises should integrate material loss indicators into responsibility accounting reports and performance evaluation systems. From a research perspective, the study contributes to applied accounting literature in Vietnam by linking responsibility accounting theory with industry-specific empirical illustration.

Future research may extend this study by employing larger datasets or comparative analyses across different cement enterprises or manufacturing sectors.

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