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# UO' K: 657:69.002(575.1) IMPROVEMENT OF ACCOUNTING AND AUDITING OF ENVIRONMENTAL ACTIVITIES IN BUILDING MATERIALS INDUSTRY ENTERPRISES

Mirzaev Komiljon Abdullajonovich

Independent Researcher, Tashkent State University of Economics

**Abstract.** This article examines issues related to improving the accounting and auditing of environmental activities in enterprises of the building materials industry. Given the high capital intensity, energy consumption, and environmental impact of the sector, the need for separate accounting of environmental assets, investments, and liabilities is substantiated. As a result of the research, an environmental accounting system based on subaccounts 0192 and 0193, a model for financing environmental investments using account 8540 and its subaccounts, a comprehensive audit approach based on accounts 9430 and 8920, and sample reporting forms aligned with ESG requirements were developed. The proposals are based on data from the joint-stock companies Kyzylkumsement, Ahangarancement, and Kuvasoysement and are aimed at increasing accounting transparency and audit efficiency.

**Keywords:** environmental accounting, environmental assets, environmental investments, subaccount, audit, depreciation, reserve, ESG report, cost.

**Аннотация.** В статье рассматриваются вопросы совершенствования бухгалтерского учета и аудита экологической деятельности на предприятиях промышленности строительных материалов. В условиях высокой капиталоемкости, энергоемкости и значительной экологической нагрузки отрасли обоснована необходимость ведения раздельного учета экологических активов, инвестиций и обязательств. По результатам исследования разработаны система экологического учета на основе субсчетов 0192 и 0193, модель финансирования экологических инвестиций с использованием счета 8540 и его субсчетов, комплексный подход к аудиту на основе счетов 9430 и 8920, а также предложены формы отчетности, соответствующие требованиям ESG. Представленные предложения основаны на данных акционерных обществ «Кызылкумцемент», «Ахангаранцемент» и «Кувасайцемент» и направлены на повышение прозрачности бухгалтерского учета и эффективности аудита.

**Ключевые слова:** экологический учет, экологические активы, экологические инвестиции, субсчет, аудит, амортизация, резерв, ESG-отчетность, затраты.

## INTRODUCTION

The building materials industry is the material basis of a country's construction complex, and its sustainable operation directly affects many sectors of the economy. In international practice, particularly in Germany, the United States, and Japan, large enterprises producing building materials maintain accounting records based on International Financial Reporting Standards. Their activities are regularly subject to independent external audits, and financial statements are presented openly to investors, government agencies, and the general public. Under such conditions, accounting and auditing serve as the main analytical sources for accurately determining product costs, consistently monitoring environmental obligations, thoroughly assessing investment projects, and substantiating management decisions (Umobong and Akani, 2015).

In Uzbekistan, the building materials industry is characterized by high capital intensity, strong dependence on resources, high energy consumption, and a significant environmental burden. In the context of volatility in raw material and energy prices, high transport and logistics costs, and increasing environmental obligations, the proper organization of the accounting and auditing system is becoming a decisive factor in optimizing production costs, increasing profit margins, attracting investment flows, and expanding international financial

cooperation. However, in the current accounting system, environmental assets are often reflected as part of ordinary fixed assets, while environmental costs are included in general production costs, which complicates their accurate accounting, analysis, and audit.

The purpose of this study is to develop scientific proposals and practical recommendations for improving the accounting and auditing of environmental activities in enterprises of the building materials industry. The object of the study is the accounting and auditing system of the joint-stock companies Kyzylkumsement, Ahangarancement, and Kuvasoysement. The article first critically analyzes the literature on the topic, then discusses the research methodology. In the analysis and results section, four scientific innovations developed by the author are substantiated: an accounting system based on subaccounts for environmental fixed assets, a model for financing environmental investments, a comprehensive audit approach to environmental assets, and standard reporting forms that meet ESG requirements.

## LITERATURE REVIEW

Theoretical and methodological issues of accounting and auditing in the building materials industry have been widely discussed in foreign literature. Rahman et al. (2017) empirically studied the use of cost and management accounting tools in the cement industry of Bangladesh and demonstrated that the technological characteristics of the industry impose specific requirements on the accounting system. Umobong and Akani (2015), based on the example of Nigerian cement and beer companies, substantiated that the introduction of International Financial Reporting Standards significantly improves the quality of accounting information.

Among Russian researchers, Kudin (2010) studied the issues of accounting and analysis of environmental protection costs in cement production, Rubanova (2005) examined the problems of organizing environmental accounting in the building materials industry, and Sabiryanova (2012) analyzed the development of risk-based management accounting in this sector. Although these studies emphasize the need for separate accounting of environmental costs, they do not fully disclose a specific system of subaccounts and audit procedures in accordance with the national chart of accounts.

International requirements in the field of sustainability reporting have been fundamentally updated in recent years. The GRI Standards (2021) created a universal framework for disclosing environmental and social information, while IFRS S1 and IFRS S2, adopted by the IFRS Foundation in 2023, require the consistent integration of sustainability- and climate-related information with financial reporting. This creates qualitatively new information needs for the accounting and reporting systems of enterprises.

In the national economic literature, Khasanov (2004) systematically studied issues related to improving management accounting and internal audit methodology; Avlokulov (2019) examined the theoretical and methodological foundations of accounting and auditing financial results; Ilkhamov (2021) developed the concept of organizing internal audit; and Khajimuratov (2020) explored the theory, methodology, and practice of financial statement auditing. Shermamatov (2025) substantiated the need to improve the audit of long-term assets based on international standards and noted that the compliance of audit processes in Uzbekistan with international requirements remains insufficient.

Nevertheless, existing studies have not systematically examined the issues of accounting for environmental assets, environmental investments, and related liabilities in separate subaccounts in the building materials industry, auditing their depreciation burden, and developing reporting forms that meet ESG requirements. This article aims to fill this research gap.

## RESEARCH METHODOLOGY

The research employed methods of grouping, comparison, induction and deduction, analysis and synthesis, economic and statistical analysis, systematic analysis, monographic study, expert assessment, as well as graphical and tabular analysis. In substantiating the audit procedures, elements of regression analysis were used to assess the relationship between costs and production volume, together with vertical and horizontal analysis.

The research design is based on a combination of case study and comparative analysis. Large enterprises of the industry, namely the joint-stock companies Kyzylkumsement, Ahangarancement, and Kuvasoysement, were selected as the research objects.

The primary data included the financial statements of these enterprises for 2020–2023, documents related to environmental investment projects, and internal accounting registers. Secondary sources included official data from the Statistics Agency of the Republic of Uzbekistan and materials from the national database of legislative documents.

The reliability of the research results was ensured by comparing the financial statement data of the enterprises with audit results, while the validity of the study was supported through the triangulation of regulatory legal documents, enterprise data, and expert assessments.

## ANALYSIS AND RESULTS

The analysis showed that, in the studied enterprises, long-term environmental assets, including dust and gas cleaning equipment, wastewater treatment facilities, and waste processing systems, are generally reflected in current accounting practice as ordinary fixed assets under account 0100, "Fixed Assets." As a result, the necessary information for management, investors, and auditors regarding the value of environmental assets, depreciation charges, and the effectiveness of investments in these assets is not sufficiently formed. Consequently, environmental costs remain less visible in the cost structure. This situation limits the analytical capabilities of the audit process and reduces it to the level of formal inspection. The following four scientific innovations are aimed at addressing these issues.

As the first scientific innovation, an accounting system based on synthetic account 0100, "Fixed Assets," and subaccounts 0192, "Fixed Assets for Atmospheric Protection," and 0193, "Fixed Assets for Production and Consumption Waste Management," was developed. This system is intended to ensure the separate control of fixed assets used for atmospheric protection and for managing production and consumption waste in the process of ensuring environmental safety at enterprises of the building materials industry.

Subaccount 0192 records equipment designed to prevent atmospheric pollution, such as electrostatic filters, water purification columns, hot gas capture systems, and similar devices. Subaccount 0193 records equipment used for waste collection, sorting, and utilization, including container presses, crushers, waste incinerators, and treatment lines.

The structure of accounts intended for environmental investments and current expenses, together with the proposed system of subaccounts, is presented in Table 1.

Table 1

Proposed accounts and subaccounts for accounting for environmental costs and assets

| Account/<br>subaccount | Naming                                                          | Objects to be considered                                                                           |
|------------------------|-----------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| 0600                   | Environmental protection investment costs                       | Wastewater treatment plant, dust collector and filter systems, purchase of environmental equipment |
| 3200                   | Current environmental protection costs                          | Filter cleaning, environmental laboratory, atmospheric monitoring, maintenance costs               |
| 0100/0192              | Main means of protecting the atmosphere                         | Air purification equipment, gas filtration equipment, dust collection systems                      |
| 0100/0193              | Basic means of protection against industrial and consumer waste | Waste collection containers, shredders, presses, disposal equipment                                |

Source: author's work.

The proposed environmental accounting system is based on a combination of synthetic and analytical accounting approaches. Synthetic accounting forms aggregate amounts in the balance sheet and serves as the basis for preparing reports for external users. Analytical accounting, in turn, provides detailed information on each environmental object by source, project, date, and purpose, thereby meeting the needs of internal management, analysis, and audit.

For example, a dust collector worth UZS 1 billion installed at Kyzylkumsement or Kuvasoysement is initially recorded as an investment expenditure under account 0600 and subsequently recognized as a fixed asset under subaccount 0192 of account 0100. During its 10-year useful life, annual depreciation of UZS 100 million is charged to expenses, while annual maintenance costs of UZS 60 million for the equipment are recorded under account 3200. The introduction of this subaccounting system makes it possible to transparently reflect environmental costs and investments, create a reliable database for internal and external audits, and bring national accounting practices closer to international environmental accounting standards (Rubanova, 2005; GRI, 2021).

As the second scientific innovation, a scientifically grounded model was developed based on account 8540, "Financing of Environmental Investment Costs," and its subaccounts 8541, "Environmental Investments in Mining Processes," 8542, "Environmental Investments in the Crushing and Sorting Department," and 8543, "Environmental Investments in Cement Production." This model is aimed at clearly distinguishing the share of

state programs, the enterprise's own funds, and credit sources in the financing of environmental projects.

According to the model, when financing funds are received, the cash account is credited, while the investment cost is reflected in the debit of the corresponding 854x subaccount. When the facility is put into operation, it is transferred to the relevant subaccount of account 0100, namely 0192 or 0193. Subsequently, depreciation is charged to expenses through account 9430. The practical application of this model is presented in Table 2 using the example of environmental investments made by the studied enterprises in 2020–2023 (Table 2).

Table 2

Reflection of environmental investments in the studied enterprises according to the proposed model

| Enterprise            | Year      | Subaccount | Project content                                                        | Source of funding           | Amount, billion soums |
|-----------------------|-----------|------------|------------------------------------------------------------------------|-----------------------------|-----------------------|
| JSC «Kyzilkumcement»  | 2021      | 8541       | Gas purification equipment                                             | State environmental program | 2.5                   |
| JSC «Kyzilkumcement»  | 2022      | 8542       | Modernization of wastewater treatment system                           | Own funds                   | 1.8                   |
| JSC «Kyzilkumcement»  | 2023      | 8543       | Energy-efficient heating equipment                                     | Loan funds                  | 2.2                   |
| “Ahangarancement” JSC | 2020–2022 | 8541–8543  | Waste management and energy efficiency projects                        | Own funds                   | 1.2–3.4               |
| «Kuvasoyscement» JSC  | 2020–2022 | 8541–8543  | Air purification system, environmental laboratory, recycling equipment | Own funds                   | 1.5; 0.9; 1.6         |

*Source: Compiled by the author based on data from “Kyzilkumsement”, “Ahangarancement” and “Kuvasoyssement” JSCs.*

As can be seen from the table, Kyzilkumsement JSC implemented environmental investments using diversified financing sources, including the state environmental program, its own funds, and credit resources. In contrast, Ahangarancement JSC and Kuvasoyssement JSC financed environmental projects mainly from internal sources.

The proposed account 8540 and its subaccounts make it possible to separate the source of financing for each project by technological stage, strengthen control over the targeted use of state programs and preferential loans, and assess the effectiveness of environmental investments based on indicators such as payback period, net present value, and internal rate of return. This represents a further development of the risk-oriented management accounting concept adapted to the specific characteristics of the industry (Sabiryanova, 2012).

As the third scientific innovation, a comprehensive audit approach was developed based on accounts 9430, “Depreciation Expenses of Environmental Assets,” and 8920, “Reserves for Expenses Related to Environmental Assets.” This approach is aimed at assessing the economic efficiency of environmental assets, analyzing their depreciation burden, and classifying liabilities into contingent and specific categories.

According to this approach, the auditor first verifies the correctness of depreciation calculations for each environmental asset recorded in subaccounts 0192 and 0193, as well as their impact on production costs. Second, the auditor assesses whether a reserve has been formed under account 8920 for environmental liabilities with a high probability and reliably estimated amount, and whether possible risks are disclosed in the notes as contingent liabilities. Third, in addition to vertical and horizontal analysis, the auditor comprehensively assesses risk factors using indicators such as the regression relationship between costs and production volume, unit costs, profit margins, and energy consumption.

The practical significance of this approach is clearly reflected in the data of the studied enterprises. In particular, at Kyzilkumsement JSC, production costs increased from UZS 224 billion in 2020 to UZS 331 billion in 2021 and UZS 480 billion in 2022. While production volume increased by approximately 22%, costs rose by more than 45%, which indicates the need to conduct a separate audit of risk factors related to rising energy prices and the declining efficiency of outdated equipment.

The problems identified in the studied enterprises using analytical procedures within the framework of the proposed comprehensive audit approach are summarized in Table 3.

Table 3

Issues identified based on analytical procedures applied within the framework of a comprehensive audit approach

| No. | Enterprise              | Identified problem                        | Main indicators                                                     | Audit conclusion and recommendation                                                            |
|-----|-------------------------|-------------------------------------------|---------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| 1   | JSC<br>«Kyzilkumcement» | Excessive raw material consumption        | Standard: 1.45 t/ton; actual: 1.62 t/ton (+11.7%)                   | Waste of resources due to outdated conveyor system; modernization of the transportation system |
| 2   | “Ahangarancement” JSC   | Tannarx’s miscalculation                  | On the account: 480 thousand soums; in practice: 525 thousand soums | Depreciation and energy costs are misallocated; reallocate costs across products               |
| 3   | «Kuvasoymcement» JSC    | Cost differences between shops            | Section A: 350,000 soums; Section B: 405 thousand soums             | High energy consumption in workshop B; upgrade equipment, increase productivity                |
| 4   | “Ahangarancement” JSC   | Low profitability                         | Sales: 580 thousand soums; cost: 545 thousand soums; profit: 6%     | Pricing policy is not ensuring profitability; review prices and costs                          |
| 5   | JSC<br>«Kyzilkumcement» | Disproportionate increase in energy costs | Production: +8%; energy consumption: +19% (2021–2023)               | Ovens are not energy efficient; introduce energy-efficient technologies                        |

Source: Results of an audit analysis conducted by the author based on data from enterprises.

It is evident that the comprehensive audit approach based on accounts 9430 and 8920 raises the audit process from a formal examination to an analytical and evaluative level. Within this approach, the auditor assesses not only the accuracy of accounting records, but also the sustainability of the enterprise's activities through the depreciation burden of environmental assets, the composition of liabilities, and risk indicators. This is closely related to the conclusions on improving the audit of long-term assets based on international standards (Shermamatov, 2025) and serves to increase the analytical potential of financial statement audits (Khajimuratov, 2020).

As the fourth scientific innovation, model reports that meet environmental, social, and governance (ESG) requirements were developed by separating the environmental and social components of costs. These model reports consist of four interrelated forms. The first is an integrated cost matrix that compares raw materials, labor, energy, depreciation, environmental costs, and social costs with normative and actual costs by product type. The second is a report form that classifies each cost at the transaction level into environmental, social, or governance categories and evaluates it using an index. The third is a sustainability analysis form that links ESG activities in terms of cost, strategic impact, plan implementation, and audit status. The fourth is a visual metrics panel generated in real time for management purposes. The structure of this panel, based on aggregated data from the studied enterprises, is presented in Table 4.

Table 4

Visual metrics dashboard ( aggregated data) compliant with ESG requirements

| Indicator                       | 2021. | 2022. | 2023. | Change  | Comment                              |
|---------------------------------|-------|-------|-------|---------|--------------------------------------|
| Total expenses, billion soums   | 92.5  | 103.7 | 111.9 | +9.7%   | Tannarx is growing                   |
| Share of environmental costs, % | 2.8   | 3.4   | 3.9   | +1.1 bp | New cleaning technologies introduced |
| Cost/benefit ratio              | 0.78  | 0.82  | 0.85  | +0.07   | Profitability pressure is increasing |
| ESG Performance Index           | 0.62  | 0.68  | 0.74  | +0.12   | There is a positive shift            |

Source: author’s calculations based on enterprise data.

The proposed sample reports disaggregate costs by product type, technological stage, workshop, or project; identify deviations between normative and actual values in real time; and present environmental and social costs as separate indicators. On the one hand, this forms an information base in accordance with the requirements of GRI (2021) and IFRS S1 and S2 (IFRS Foundation, 2023), thereby increasing enterprise transparency for international investors and rating agencies. On the other hand, it enables auditors to assess the relationship between financial and management accounting, as well as the economic substance of transactions, on a documentary basis.

Thus, the four scientific innovations form a single integrated system: the subaccounting system based on subaccounts 0192 and 0193 ensures accurate accounting of environmental assets; the financing model based on account 8540 and subaccounts 8541–8543 ensures transparency of investment sources; the integrated audit approach based on accounts 9430 and 8920 ensures the reliability of control and assessment; and ESG reports ensure effective communication of results to stakeholders.

## CONCLUSION AND RECOMMENDATIONS

The research made it possible to formulate the following conclusions and proposals for improving the accounting and auditing of environmental activities in enterprises of the building materials industry.

First, the introduction of an environmental accounting system based on account 0100, "Fixed Assets," with subaccounts 0192 and 0193 makes it possible to separately control fixed assets used for atmospheric protection and protection against emissions, monitor their depreciation, and assess the effectiveness of related investments.

Second, the model based on account 8540 and its subaccounts 8541–8543 separates the sources of financing for environmental investments, including state programs, own funds, and credit resources, by technological stages, thereby strengthening control over their targeted use.

Third, a comprehensive audit approach based on accounts 9430 and 8920 raises the audit process from a formal review to an evaluative level through analytical procedures based on regression analysis and indicators, along with the assessment of the depreciation burden of environmental assets and the classification of liabilities into contingent and specific categories.

Fourth, model reports that comply with ESG requirements highlight environmental and social costs separately, ensuring that enterprises are prepared to meet international sustainability reporting requirements.

To implement the developed proposals, it is advisable to introduce the proposed system of subaccounts into the accounting policies of enterprises, present the results of environmental obligations, waste management, and environmental monitoring as a separate segment in audit reports, integrate reporting forms into automated enterprise management systems, and improve the qualifications of internal auditors in environmental and social auditing.

Future research may be continued in the areas of real-time monitoring of environmental risk indicators using digital technologies and artificial intelligence tools, as well as the practical testing of the proposed accounting and audit model in other enterprises of the industry.

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