

INNOVATION SCIENCE AND TECHNOLOGY

ISSUE 10, PART I / OCTOBER 2026

 **Acceptance of papers**



**Acceptance of
papers**

Published monthly



Topics

economics,
technology, social
sciences



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THE SCIENTIFIC-POPULAR ELECTRONIC
JOURNAL **"INNOVATION SCIENCE AND
TECHNOLOGY"** HAS BEEN REGISTERED
UNDER THE NUMBER **C-5669633** BY THE
AGENCY FOR INFORMATION AND MASS
COMMUNICATIONS (AOKA) OF THE
REPUBLIC OF UZBEKISTAN, EFFECTIVE
FROM OCTOBER 9, 2024.

CONTACTS

Phone: **+998 50 737 87 88**

Website: <https://ist-journal.uz>

Email: innovationist2025@gmail.com

The scientific electronic journal "Innovation Science and Technology" has been included in the list of scientific publications recommended for the publication of main scientific results of dissertations for the award of PhD and DSc degrees in economics and technical sciences, in accordance with the Resolution No. 370 of the Presidium of the Higher Attestation Commission of the Republic of Uzbekistan, dated May 8, 2025.

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GREEN INNOVATION-INVESTMENT EFFECTIVENESS AND STRATEGIC FORECASTING IN THE CABLE INDUSTRY: EVIDENCE FROM UZKABEL

Igamberdiev Karimberdi Abdullaevich

Head of the Department

*Tashkent University of Information Technologies named after
Muhammad al-Khwarizmi*

E-mail: igamberdiev-71@mail.ru

ORCID: <https://orcid.org/0000-0002-6192-232X>

Abstract. Cable manufacturing is characterized by energy-intensive production processes and significant exposure to fluctuations in copper prices, making green investment decisions closely interconnected with financial performance. This article develops an integrated approach to assessing green innovation-investment effectiveness and strategic forecasting, using publicly available financial data and scenario-based calculations for Uzkabel Joint Venture as an applied case. The methodology links investment intensity, operating profitability, energy intensity, the share of recycled copper, and the minimum required return for capital recovery. Scenario-based calculations through 2030 indicate that, under the assumption of preferential green financing, the estimated threshold return decreases from **0.255 to 0.209**. The proposed approach provides a methodological basis for jointly assessing the financial and resource-efficiency dimensions of green investment decisions in cable manufacturing.

Keywords: green innovation, investment effectiveness, cable industry, energy efficiency, recycled copper, green finance, scenario forecasting, Uzkabel.

Annotatsiya. Kabel ishlab chiqarish energiya sig'imi yuqori bo'lgan texnologik jarayonlar hamda mis narxlarining o'zgarishiga sezgirlik bilan tavsiflanadi. Shu sababli yashil investitsiyalar samaradorligini ekologik natijalar va kapital xarajatlari bilan bir qatorda, ularning rentabellik, energiya sig'imi hamda ikkilamchi mis ulushiga ta'sirini o'zaro bog'liq holda baholash muhim ahamiyatga ega. Maqolada «Uzkabel» AJ QK faoliyatiga oid ochiq moliyaviy ma'lumotlar va 2030-yilgacha bo'lgan ssenariyli hisob-kitoblar asosida yashil innovatsion-investitsion faoliyat samaradorligini baholash va strategik prognozlashning integrallashgan yondashuvi ishlab chiqilgan. Metodologiyada investitsiya jadalligi, asosiy faoliyat rentabelligi, energiya sig'imi, ikkilamchi mis ulushi hamda kapitalni qoplash uchun talab etiladigan minimal qaytim o'zaro bog'liq holda baholanadi. Ssenariyli hisob-kitoblar imtiyozli yashil moliyalashtirish sharoitida hisoblangan chegaraviy qaytim **0,255 dan 0,209 gacha** o'zgarishini ko'rsatadi. Taklif etilgan yondashuv kabel sanoatida yashil investitsiya qarorlarining moliyaviy va resurs samaradorligini kompleks baholash uchun metodologik asos yaratadi.

Kalit so'zlar: yashil innovatsiya, investitsiya samaradorligi, kabel sanoati, energiya samaradorligi, ikkilamchi mis, yashil moliyalashtirish, ssenariyli prognozlash, Uzkabel.

Аннотация. Производство кабельной продукции характеризуется высокой энергоёмкостью технологических процессов и чувствительностью к колебаниям цен на медь, что обуславливает тесную взаимосвязь зелёных инвестиционных решений с финансовыми результатами. В статье предлагается интегрированный подход к оценке эффективности зелёной инновационно-инвестиционной деятельности и стратегическому прогнозированию на примере СП АО «Uzkabel» с использованием открытых финансовых данных и сценарных расчётов до 2030 года. Методология объединяет показатели интенсивности инвестиций, рентабельности основной деятельности, энергоёмкости, доли вторичной меди и минимально необходимой отдачи для возмещения капитала. Сценарные расчёты показывают, что при условии льготного зелёного финансирования расчётное пороговое значение отдачи изменяется с **0,255 до 0,209**. Предложенный подход формирует методологическую основу для комплексной оценки финансовой и ресурсной эффективности зелёных инвестиционных решений в кабельной промышленности.

Ключевые слова: зелёные инновации, эффективность инвестиций, кабельная промышленность, энергоэффективность, вторичная медь, зелёное финансирование, сценарное прогнозирование, Uzkabel.

INTRODUCTION

The cable industry is strategically important for electrification, power transmission, telecommunications, and industrial development. At the same time, cable manufacturing is characterized by specific structural efficiency requirements: copper and aluminium account for a substantial share of material costs, while drawing, extrusion, insulation, winding, and testing processes are energy-intensive and require significant capital investment in equipment. Consequently, a green investment project can generate several forms of value simultaneously, including lower electricity consumption, reduced material losses, a smaller product carbon footprint, improved process reliability, and enhanced access to customers that require documented environmental performance. However, these benefits may not necessarily translate directly into higher profitability. Therefore, green investment projects should be selected, financed, implemented, and evaluated in a manner that links environmental improvements with measurable operating and financial results.

The international cable market is increasingly recognizing circular materials and product-level environmental information as important strategic capabilities. Nexans reports that its low-carbon cable range can reduce emissions by up to **40%** compared with standard equivalents and has established a target for increasing the share of recycled copper in its copper rods. Prysmian similarly reports an increasing use of recycled materials and growing revenue from sustainable solutions [5, 7]. These corporate disclosures should be interpreted with due consideration of differences in reporting scope, baseline assumptions, and product boundaries. Nevertheless, they indicate that material circularity and measurable environmental performance are increasingly becoming integral elements of product development and investment strategies rather than being limited to corporate communication activities.

LITERATURE REVIEW

Innovation measurement has traditionally distinguished product and process innovations from the financial inputs required for their development and implementation. The Oslo Manual provides a systematic framework for measuring business innovation and emphasizes the importance of distinguishing between innovation activities, implemented innovations, and their outcomes [6]. For capital-intensive manufacturers, however, identifying individual innovations alone may not provide a complete assessment of their effectiveness. An upgraded machine, for example, may require a certain adjustment period before achieving its planned throughput, while a technically successful new product may need additional time to generate the expected margin. Therefore, an effective evaluation framework should link investment inputs with operating outcomes over an appropriate and realistic time lag.

The energy-management literature provides a complementary perspective. ISO 50001 establishes a management-system framework for the continual improvement of energy performance through energy baselines, performance indicators, targets, measurement, and periodic review [3]. Its key implication for industrial investment is procedural: energy efficiency should be managed as a continuous improvement cycle rather than being considered solely as a one-time equipment investment. In a cable manufacturing plant, relevant indicators may include **kWh per tonne of finished cable, electricity costs as a share of sales, energy consumption by production process, scrap rates, and machine utilisation**. These indicators should be measured before and after an intervention, while accounting for changes in output mix and operating hours, so that measured energy savings can be distinguished from the effects of variations in production volumes.

A circular-economy perspective is equally important because the environmental footprint of cable products depends not only on energy consumption within the manufacturing facility but also on conductor materials and impacts across the broader product life cycle. Nexans identifies the use of recycled copper and aluminium as important mechanisms for reducing reliance on primary raw materials and lowering the environmental footprint of cable products [5]. Prysmian's sustainability reporting similarly links recycled-material content with resource efficiency and revenues generated from sustainable solutions [7]. These examples support an integrated product-and-material perspective in which the share of recycled metals, waste recovery rates, and sales of low-carbon products are monitored alongside energy-performance indicators. At the same time, the use of recycled inputs should be considered in conjunction with applicable technical and quality requirements rather than as a standalone target. Recycled materials must comply with electrical, mechanical, safety, and customer specifications; therefore, quality assurance and product certification should be incorporated into the overall assessment of green investment effectiveness.

RESEARCH METHODOLOGY

The study employs a quantitative case-study design that combines historical financial indicators, threshold-

return calculations, strategic alternatives, and scenario-based forecasting. The case data cover Uz Kabel's reported financial performance for **2020–2025** and modelled operating outcomes for **2026–2030**. Historical indicators are derived from the company's annual issuer disclosures for 2020–2025 [8], while forecast values are treated as model-based scenario outputs rather than realised results. External sources are used to contextualise the green-management framework and relevant industry practices, while company-specific data remain the primary basis for the empirical analysis.

For the detailed diagnostic assessment, a 10% sample of the compiled observation units and indicator records related to Uz Kabel's green innovation–investment activities was selected and used for in-depth analysis.

A key methodological consideration relates to the scope of publicly available disclosures. Public reporting provides only partial disaggregation of several variables required for a comprehensive assessment of green investment returns, including process-level energy consumption, the share of recycled metals in purchased conductors, the volume of new-product sales, and detailed expenditures on training, testing, and certification. Accordingly, the analysis clearly distinguishes reported financial values from scenario assumptions and proposed monitoring indicators. The forecasts are therefore interpreted as conditional scenario-based outcomes under specified assumptions rather than as deterministic projections of future performance.

The analytical framework begins with the conventional operating-return measure and extends it by incorporating green-performance channels. Let J denote investment intensity as a share of net sales; π denote operating profitability; e denote energy-cost intensity; R denote the recycled-metal share; and Y denote the share of new or environmentally improved products in sales. For a multi-period assessment, the historical innovation-investment return is expressed as:

$$Q = \Delta\pi / \Sigma J$$

Where:

$\Delta\pi$ represents the change in operating profitability over the specified implementation period;
while ΣJ denotes cumulative investment intensity over the corresponding investment period.

The resulting ratio is interpreted jointly with the minimum return threshold Q^* [5], which depends on the cost of financing and the useful life of the equipment. The indicator should be regarded as a methodology-specific analytical measure, with its interpretation determined by the observation period, denominator definition, and method used to calculate investment intensity. In the Uz Kabel case, assuming a **22%** corporate financing rate and a **10-year** useful life of equipment produces a baseline threshold of **0.255**.

The green extension incorporates three additional assessment dimensions. First, the energy channel evaluates whether the intervention contributes to reducing energy consumption or energy costs per unit of output, as well as the energy-cost share of sales. Second, the circular-material dimension requires the recycled-metal share to be systematically reported and technically validated. Third, the financing threshold is recalculated when access to eligible green financing results in a lower cost of capital. If a project were financed using a benchmark corresponding to the **16.25% coupon rate** of Uzbekistan's sovereign green Eurobond [2], the modelled threshold would decrease from **0.255 to 0.209**. This represents a reduction of **0.046 points**, or approximately **18.0%**, in the required threshold. The coupon rate is used solely as a benchmark assumption and does not imply that Uz Kabel would necessarily obtain financing at the same rate, as corporate financing conditions may include additional margins, transaction costs, and eligibility requirements. A lower financing threshold can improve the project's financial feasibility; however, the overall investment outcome ultimately depends on whether the achieved return exceeds the applicable threshold.

ANALYSIS AND RESULTS

The historical indicators show that the company's profitability followed a variable trajectory, while investment intensity declined over the observed period. Operating profitability increased to **14.16%** in 2021, reached **3.03%** in 2022, improved to **8.39%** in 2023, and subsequently stood at **6.20%** in 2025. Over the same period, capital investment intensity changed from **5.78%** in 2020 to **0.25%** in 2025. The cost-of-goods-sold share reached **87.79%** in 2025, while the fixed-asset depreciation rate was estimated at **66.05%**. Taken together, these indicators highlight the importance of further strengthening production-asset renewal and suggest that profitability remains sensitive to changes in material and operating costs (Table 1).

Table 1

Key Indicators for Assessing Green Innovation–Investment Effectiveness at Uzkabel, 2020–2025¹

Indicator	2020	2023	2025	Strategic interpretation
Operating profitability, %	8.61	8.39	6.20	Margin weakened after the 2023 recovery
Capital investment intensity, %	5.78	3.24	0.25	Low renewal intensity by 2025
Cost of goods sold / net sales, %	83.83	86.38	87.79	Material and production costs constrain margins
Fixed-asset depreciation, %	71.49	60.49	66.05	Asset renewal remains a priority
Inventory turnover period, days	104.8	118.9	125.8	More working capital is tied up in inventories

The threshold calculation provides a practical benchmark for investment decision-making. At a **22% corporate financing rate** and a **10-year useful life of equipment**, the minimum required return is estimated at **0.255**. Under the preferential green-financing scenario, this threshold decreases to **0.209**. This adjustment is economically meaningful because it reduces the minimum return required for an eligible investment project. At the same time, the historical innovation-investment return for **2020–2025** remains below zero according to the company-level calculations. This finding indicates that green financing should be considered as a supportive financial mechanism rather than as a standalone determinant of investment effectiveness. Accordingly, preferential green-financing resources should be directed primarily towards projects that demonstrate verifiable energy savings and a credible potential for improving operating margins.

The proposed strategy is structured around four mutually reinforcing workstreams. The first focuses on **management and measurement**: establishing separate records for energy costs, employee training, product testing and certification, new-product sales, and recycled-material use; introducing a project-approval mechanism based on expected returns; and systematically evaluating actual outcomes after project implementation. The second focuses on **resources and technology**: optimising inventory management, strengthening preventive maintenance, modernising capacity-constraining equipment, prioritising the renewal of equipment where economically justified, and enhancing operator skills to ensure that new equipment achieves its expected technical and economic performance (Table 2).

Table 2

Proposed Strategic Implementation Roadmap for Green Innovation and Investment at Uzkabel, 2026–2030²

Stage	Timing	Priority actions	Monitoring indicators
1. Prepare and measure	2026	Energy audit; establish energy/material baselines; improve inventory control; approve investment rules	kWh per tonne; energy-cost share; inventory days; Q and Q*
2. Modernise and decarbonise	2027–2028	Upgrade bottleneck machines; energy-efficient drives; evaluate renewable power; track recycled metal	Investment intensity; energy return; scrap rate; recycled-metal share
3. Develop products and markets	2028–2030	Scale special and low-halogen cables; testing and certification; develop export channels	New-product sales share; contribution margin; certified product count; export sales

The product-market strategy prioritises product development while maintaining a gradual approach to entering more demanding market segments. The company can build on its existing customer relationships and product portfolio to introduce more specialised cable products, including low-halogen and fire-resistant cables, while preparing for higher-standard markets through appropriate testing and certification. This approach is consistent with the broader industry trend towards environmental product declarations and the use of recycled inputs. At the same time, environmental claims should be supported by traceable input data and product-level testing to ensure transparency, technical reliability, and market credibility [5, 7].

The proposed three-year investment programme requires a total of **UZS 166.4 billion** for **2026–2028**. According to the underlying calculation, **UZS 84.0 billion** is expected to be generated through the release of

¹ Author's calculations based on Uzkabel's annual financial reports and issuer disclosures.

² Author's elaboration based on the proposed strategic programme and monitoring framework

working capital, **UZS 52.3 billion** from retained operating profits, and **UZS 30.0 billion** from preferential or green credit facilities. This financing structure combines internal resources with targeted external financing and can support a more balanced implementation of the proposed modernisation and green-investment programme (Table 3).

Table 3

Proposed Financing Structure for the Strategic Green Investment Programme, 2026–2028³

Financing source	UZS billion	Share of total, %	Role in the programme
Working-capital release	84.0	50.5	Inventory and process-flow optimisation
Retained profit	52.3	31.4	Co-finance staged modernisation and capability building
Preferential / green credit	30.0	18.0	Support the 2028 equipment replacement stage
Total	166.4	100.0	Three-year planned financing requirement

A financing plan of this kind should incorporate two key control principles. First, the release of working capital should be implemented while maintaining essential safety stocks and quality-control materials at levels consistent with operational requirements. Second, eligibility for green credit should be linked to documented project-level outcomes, including energy consumption before and after the intervention, verified equipment specifications, and an auditable calculation of green investment returns. **ISO 50001** provides an appropriate management-system framework for establishing energy baselines, monitoring performance indicators, and systematically reviewing improvements [3].

The three scenarios demonstrate distinctly different development trajectories by **2030**. Under the inertial scenario, operating profit is projected at **UZS 70.9 billion**, compared with **UZS 103.1 billion** in 2025, representing a **31.3% decrease**. Under the strategic scenario, operating profit is projected to reach **UZS 148.4 billion**, corresponding to a **43.9% increase** relative to 2025. Under the optimistic scenario, operating profit is projected at **UZS 188.1 billion**, representing an **82.4% increase**. These figures represent conditional scenario-based model outcomes and should therefore be interpreted within the assumptions underlying each scenario rather than as predetermined future results. Their analytical value lies in illustrating the potential differences between the continuation of the current development trajectory and the implementation of the proposed operational, investment, and product-development strategy (Table 4).

Table 4

Scenario-Based Forecast of Uzkabel's Operating Profit, 2025–2030⁴

Year	Inertial A, UZS bn	Strategic B, UZS bn	Optimistic C, UZS bn
2025 (reported base)	103.1	103.1	103.1
2026	104.6	104.6	104.6
2027	50.3	60.6	68.5
2028	67.5	99.4	116.8
2029	69.2	122.5	150.4
2030	70.9	148.4	188.1

The strategic scenario should be interpreted as more than a sales-growth pathway. It assumes a recovery in operating profitability from **6.20% in 2025 to 8.64% in 2030**, together with an increase in net sales under the modelled conditions. This is particularly important because the company's cost-of-goods-sold share reached **87.79% in 2025**, highlighting the importance of maintaining effective cost management. Accordingly, the strategy should focus on reducing material and process losses, improving asset utilisation, and shifting the product mix towards products capable of sustaining higher margins. If newly introduced products generate relatively modest margins or require additional rework, the expected financial benefits may be realised more gradually, even as the product portfolio becomes more innovative (Figure 1).

³ Author's development

⁴ Author's development

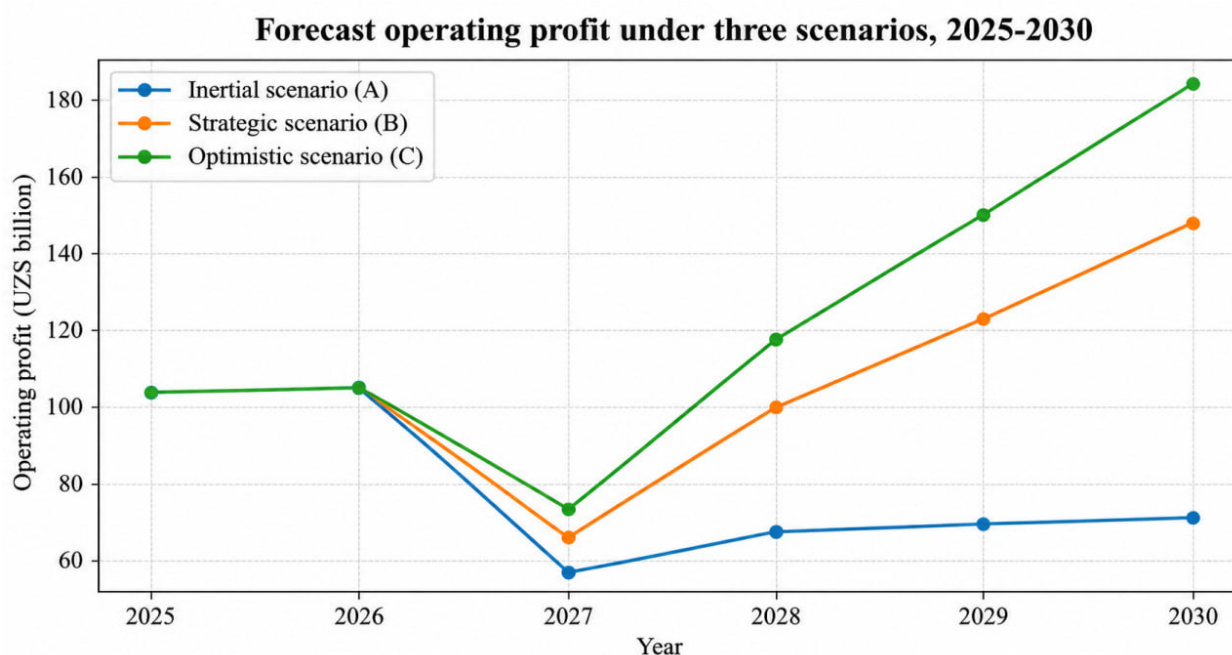


Figure 1. Forecast operating profit under three scenarios, 2025–2030⁵

Copper-price sensitivity also remains an important factor in interpreting the forecast results. The econometric estimate used in the model places the sales elasticity with respect to the **UZS-denominated copper price at 0.835**, indicating that reported revenue and operating results may vary in response to changes in the metal-price environment. Therefore, the forecast seeks, as far as the available data allow, to distinguish the effects of the proposed strategy from changes associated with copper-price movements. In practical application, the company should monitor both nominal profitability and a metal-price-adjusted performance indicator, alongside energy-use and recycled-material measures. This approach can help management distinguish the operational and investment-related effects of the strategic programme from favourable movements in commodity prices.

CONCLUSION AND RECOMMENDATIONS

This article proposes an integrated approach to evaluating **green innovation-investment effectiveness** in cable manufacturing. The approach links investment intensity and operating profitability with energy-cost intensity, the use of recycled metals, product innovation, and the minimum return required for capital recovery. In the Uzkabel case, the estimated return threshold decreases from **0.255 to 0.209** under the modelled preferential green-financing scenario, indicating that access to appropriately structured green-financing instruments can improve the financial feasibility of eligible investment projects. In this regard, it is advisable to link green-financing decisions with measurable indicators such as energy savings, material efficiency, recycled-metal use, and expected improvements in operating profitability.

The scenario-based forecast indicates that operating profit in 2030 may reach **UZS 70.9 billion** under the inertial scenario, **UZS 148.4 billion** under the strategic scenario, and **UZS 188.1 billion** under the optimistic scenario. Relative to the **2025 baseline**, these outcomes correspond to changes of **–31.3%, +43.9%, and +82.4%**, respectively. These results highlight the importance of combining equipment modernisation with improvements in material and energy efficiency, asset utilisation, and the development of higher-value cable products. At the same time, establishing a systematic monitoring framework for energy consumption, recycled-material use, product-level margins, and actual post-investment returns would strengthen the quality of future investment decisions and enable more accurate assessment of green innovation outcomes.

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⁵ Source: author's visualisation of the scenario values in Table 4.

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Proofreader: Zokir ALIBEKOV

Layout and Designer: Oloviddin Sobir ugli

2026. № 10

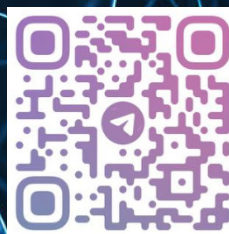
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