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ANALYSIS OF PRODUCTION EFFICIENCY IN CONSTRUCTION MATERIALS MANUFACTURING ENTERPRISES: EVIDENCE FROM ANDIJAN REGION

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Abstract: This article analyzes production efficiency in construction materials manufacturing enterprises in Andijan Region of the Republic of Uzbekistan during 2017–2025. The study is based on official statistical data from the National Statistics Committee of the Republic of Uzbekistan, the Andijan Regional Statistics Department, information from the Association “Uzsanoatqurilishmateriallari,” and relevant domestic and international academic literature. Production efficiency is assessed using a system of indicators including industrial output, production of other non-metallic mineral products, the sector’s share in regional industrial production, construction activity, investment activity, and production capacity utilization.

The findings demonstrate that total industrial output in Andijan Region increased from UZS 13,269.8 billion in 2017 to UZS 107,885.0 billion in 2025. During the same period, the output of other non-metallic mineral products increased from UZS 203.8 billion to UZS 3,815.2 billion. Consequently, the nominal output of this segment increased approximately 18.7 times, while its share in total regional industrial output increased from 1.54% to 3.54%. Construction activity also expanded substantially, with the volume of construction works increasing from UZS 1,782.9 billion in 2017 to UZS 15,111.4 billion in 2025.

The article recommends expanding energy-efficient technologies, increasing the use of local raw materials, introducing digital production monitoring systems, developing regional industrial clusters, increasing the share of high-value-added construction materials and introducing integrated efficiency indicators at the enterprise level.

Keywords: construction materials, production efficiency, manufacturing enterprises, Andijan Region, non-metallic mineral products, labor productivity, resource efficiency, investment, technological modernization, industrial development.

INTRODUCTION

The construction materials industry is one of the strategically important components of the industrial economy because of its strong links with construction, housing, infrastructure, transport and urban development. Growth in construction activity, urbanization and demand for modern construction products has increased the importance of improving production efficiency in manufacturing enterprises.

For construction materials manufacturers, production efficiency is determined not only by the volume of output but also by the efficient utilization of raw materials, energy, labor, capital and production capacities. Consequently, increasing output without reducing resource consumption and production costs may not necessarily result in higher economic efficiency.

In Uzbekistan, the construction materials industry has undergone significant structural transformation in recent years. Government programs have emphasized modernization, expansion of production capacities, localization of construction materials and increased utilization of domestic raw materials. In particular, Resolution of the President of the Republic of Uzbekistan No. RP-3141¹ of July 20, 2017 “On measures for the organization of the construction of a cement plant in Bulakbashi district of Andijan region” provided for the organization of a cement plant in Buloqboshi District of Andijan Region with an annual production capacity of 1.2 million tons of Portland cement [1].

Andijan Region is one of Uzbekistan’s important industrial regions. According to official statistics, industrial output in the region amounted to UZS 107,885.0 billion in 2025, while the physical volume index of industrial

1 <https://lex.uz/uz/docs/7499970>

production reached 107.2%. The volume of construction works reached UZS 15,111.4 billion, representing 113.8% compared with the previous year [2; 3].

These developments indicate that the construction materials industry has significant growth potential in the region. However, the growth of production output needs to be considered together with the efficiency of resource utilization, labor productivity, production costs, capacity utilization and technological modernization.

The objective of this study is to analyze the dynamics of production efficiency in construction materials manufacturing enterprises in Andijan Region during 2017–2025, identify the major factors affecting efficiency and develop recommendations for improving resource and economic efficiency. To achieve this objective, the study addresses the following tasks:

- to examine the theoretical approaches to production efficiency in the construction materials industry;
- to review relevant domestic and international academic literature;
- to analyze industrial and construction-sector dynamics in Andijan Region during 2017–2025;
- to assess the dynamics of other non-metallic mineral products as a proxy indicator for construction materials manufacturing;
- to evaluate the sector's share in regional industrial production;
- to identify the principal determinants of production efficiency;
- to develop practical recommendations for construction materials manufacturing enterprises in Andijan Region.

The scientific novelty of the study lies in applying an integrated regional approach to evaluating production efficiency in construction materials manufacturing by linking industrial output, non-metallic mineral products, construction demand, investment and resource efficiency.

REVIEW OF LITERATURE ON THE SUBJECT

Production efficiency in manufacturing industries has traditionally been examined through labor productivity, capital productivity, cost efficiency, technological efficiency and profitability. In resource-intensive industries such as construction materials manufacturing, energy and raw-material efficiency are particularly important.

Recent studies of Uzbekistan's construction materials industry emphasize the importance of localization, rational utilization of domestic raw materials and reduction of production costs. Abdukanieva [4] examines the rational use of local raw materials in the production of import-substituting construction materials and highlights the importance of reducing production costs and improving management efficiency.

Kasimova [5] identifies diversification, investment attractiveness, modernization and export development as important factors supporting sustainable growth in Uzbekistan's construction materials industry.

Otajanov [6] examines the effectiveness of construction materials enterprises and emphasizes the relationship between investment activity, external economic conditions and industrial development.

Uzakova [7] argues that the development mechanism of construction materials enterprises should integrate organizational and economic instruments, including competitiveness, profitability, cost management and managerial efficiency.

Recent research has increasingly focused on resource efficiency. Allasugirov [8] emphasizes the economic importance of resource-efficient construction materials, energy-saving technologies and the increased use of recycled raw materials. Such measures can reduce production costs and improve profitability.

Cluster-based approaches have also attracted academic attention. Fayzullayev [9] considers clustering an important instrument for improving efficiency in the construction materials industry through technological cooperation, reduced logistics costs and increased labor productivity.

The World Bank's productivity research in Uzbekistan has similarly emphasized the importance of labor productivity, technological adoption and enterprise-level productivity in manufacturing [10].

The literature therefore demonstrates that production efficiency should be understood as a multidimensional concept rather than simply an increase in output. Nevertheless, there is a research gap concerning the long-term regional analysis of construction materials manufacturing in Andijan Region, particularly for the period 2017–2025. This study addresses this gap by combining regional industrial statistics with construction activity and industry-specific production indicators.

RESEARCH METHODOLOGY

The study uses statistical, comparative, structural, dynamic and coefficient analysis.

The empirical database consists primarily of official statistical information from the National Statistics Committee of the Republic of Uzbekistan, the Andijan Regional Statistics Department and the Association "Uzsanoatqurilishmateriallari" [2; 11].

Because official regional statistics do not provide complete enterprise-level panel data for all construction materials manufacturers for 2017–2025, the study uses the production of other non-metallic mineral products as a principal proxy for construction materials manufacturing. The following indicators are used.

Production growth rate:

$$G_t = Q_t / Q_{t-1} * 100$$

where:

Q_t -production volume in the current year;

Q_{t-1} -production volume in the previous year.

Industry share:

$$S_t = Q_{CMT} / Q_{INDt} * 100$$

where:

Q_{CMT} -production of construction-related non-metallic mineral products;

Q_{INDt} -total industrial production.

Compound annual growth rate:

$$CAGR = \left(\frac{Q_{2025}}{Q_{2017}} \right)^{1/8} - 1$$

The CAGR is used to estimate the average annual nominal growth rate over the 2017–2025 period.

Integrated production-efficiency indicator:

For enterprise-level applications, the following methodological model is proposed:

$$IE = 0.25 * P + 0.2 * C + 0.2 * E + 0.15 * K + 0.1 * Q + 0.1 * I$$

where:

(P)-labor productivity; (C)-production-capacity utilization; (E)-energy efficiency; (K)-cost competitiveness; (Q)-product quality; (I)-innovation activity.

The weights are methodological proposals and should be calibrated using actual enterprise-level data and expert assessment.

ANALYSIS AND RESULTS

Official statistical data indicate significant growth in industrial production in Andijan Region during 2017–2025 (Table 1).

Table 1.

Industrial production and construction activity in Andijan Region, 2017–2025²

Year	Industrial output, UZS billion	Construction works, UZS billion	Industrial growth, %
2017	13,269.8	1,782.9	-
2018	27,454.7	2,819.5	206.9
2019	33,122.3	3,539.1	120.6
2020	36,376.5	4,673.0	109.8
2021	35,935.3	5,657.8	98.8
2022	54,352.5	6,864.1	151.3
2023	73,767.1	10,070.8	135.7
2024	90,626.6	12,782.8	122.9
2025	107,885.0	15,111.4	119.0

Industrial output increased from UZS 13,269.8 billion in 2017 to UZS 107,885.0 billion in 2025, representing an approximately 8.13-fold nominal increase. Construction activity increased from UZS 1,782.9 billion to UZS 15,111.4 billion during the same period, representing an approximately 8.48-fold increase (Figure 1).

² Compiled by the author based on official statistical data [2; 3].

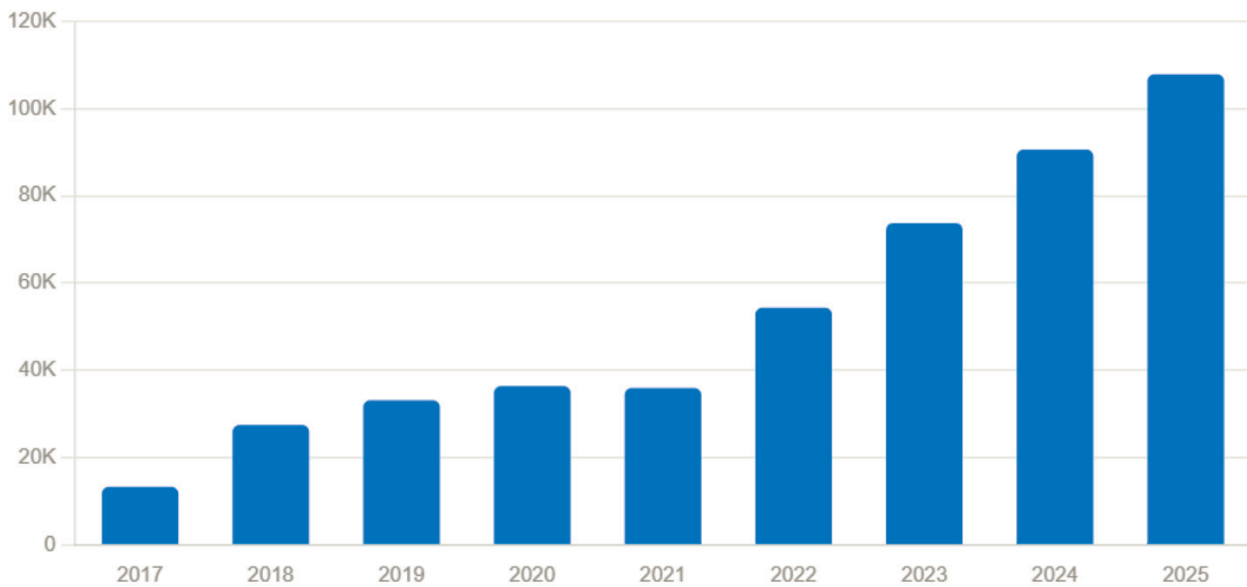


Figure 1. Dynamics of industrial output in Andijan Region (Industrial output, UZS billion, 2017–2025)³

The temporary decline in 2021 was followed by a substantial recovery in 2022. From 2022 onward, the region experienced sustained industrial growth.

For this study, the production of other non-metallic mineral products is used as the main statistical proxy for the construction materials manufacturing sector (Table 2).

Table 2.

Production of other non-metallic mineral products in Andijan Region⁴

Year	Output, UZS billion	Annual change, %	Share in regional industry, %
2017	203.8	-	1.54
2018	344.3	168.9	1.25
2019	279.8	81.3	0.84
2020	442.6	158.2	1.22
2021	523.6	118.3	1.46
2022	947.5	181.0	1.74
2023	686.0	72.4	0.93
2024	1,448.1	211.1	1.60
2025	3,815.2	263.5	3.54

The output of other non-metallic mineral products increased from UZS 203.8 billion in 2017 to UZS 3,815.2 billion in 2025.

Thus:

$$Ts = 3815.2 / 203.8 = 18.72$$

The nominal production volume increased approximately 18.72 times. The estimated CAGR is approximately 43.5%. This indicates that the construction-related non-metallic mineral products segment grew considerably faster than total regional industrial output. However, because the data are expressed in current prices, the

³ Author's visualization based on official statistics [2].

⁴ Author's calculations based on National Statistics Committee SIAT data [12].

increase should not be interpreted as a direct measure of physical productivity. Inflation and price changes may account for part of the nominal increase (Figure 2).

Output, UZS billion

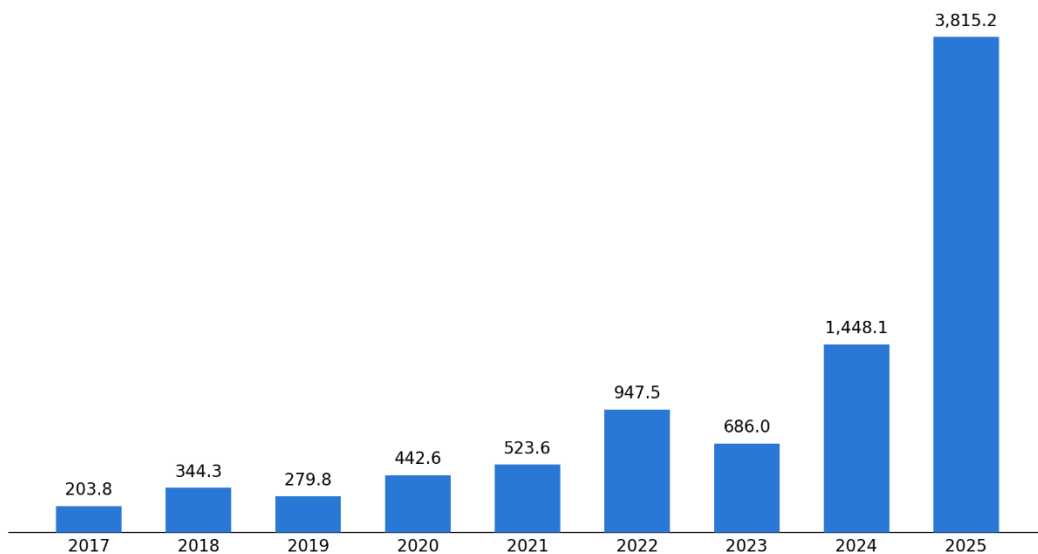


Figure 2. Production of other non-metallic mineral products⁵

The sharp increase in 2025 is particularly noteworthy. Output increased from UZS 1,448.1 billion in 2024 to UZS 3,815.2 billion in 2025.

Cement production is one of the most important components of the construction materials industry. According to the Andijan Regional Statistics Department, Portland cement production by large industrial enterprises amounted to 6.1 thousand tons in 2023 and 50.8 thousand tons in 2024. During 2025, production reached 116.8 thousand tons, representing approximately 2.9 times the corresponding period of the previous year (Table 3) [13].

Table 3.

Portland cement production in Andijan Region⁶

Period	Production, thousand tons
2023	6.1
2024	50.8
2025	116.8

The significant increase in cement production is associated with the development of new production capacities and investment projects. In 2017, the government approved measures to establish a cement plant in Buloqboshi District with an annual capacity of 1.2 million tons of Portland cement [1]. According to investment-sector information, Andijan Region had eight cement plants with a combined annual capacity of approximately 7.02 million tons in 2025 [14]. This demonstrates the increasing strategic importance of the region in the national construction materials market.

The construction materials industry in Andijan Region includes producers of cement, ready-mix concrete, reinforced concrete products, lime, cement-based boards, tiles and thermal insulation materials [15–17]. The official industry database identifies enterprises such as “Qurilish materiallari ishlab chiqarish kombinati”, “Kuyganyor temir beton buyumlari”, “Asia Elegant Star” and “Smart-Sabr Plyus” among manufacturers of concrete and reinforced concrete products [15]. “EVEREST METALL FAVORITE” LLC is listed as a Portland cement producer in Andijan Region [16].

⁵ Author's visualization based on SIAT data [12].

⁶ Andijan Regional Statistics Department [13].

Several enterprises, including “SHANS,” “Asaka Universal Lyuks,” “Xakan Ohak Savdo,” “Pomir Gips,” and “Guliston Ohak,” are involved in lime and related mineral products [17]. Product diversification has an important role in increasing enterprise efficiency because it allows manufacturers to reduce dependence on a single product category and move toward higher-value-added products. For example, “Everest Metall Grand” LLC implemented a project in Andijan City with an annual capacity of 20,000 tons of thermal insulation mineral boards, with an investment value of approximately USD 10 million [18].

Construction activity is a major source of demand for construction materials (Table 4).

Table 4.

Comparative dynamics of construction activity and construction-material-related production⁷

Indicator	2017	2025	Increase, times
Construction works, UZS billion	1,782.9	15,111.4	8.48
Industrial output, UZS billion	13,269.8	107,885.0	8.13
Other non-metallic mineral products, UZS billion	203.8	3,815.2	18.72

The data demonstrate an important structural trend: while construction activity increased 8.48 times and total industrial output increased 8.13 times, production of other non-metallic mineral products increased 18.72 times. This suggests that the construction materials segment expanded considerably faster than the overall regional industrial economy. Nevertheless, this result should be interpreted cautiously because the values are measured at current prices.

The empirical results allow five major factors influencing production efficiency in construction materials manufacturing in Andijan Region to be identified.

The 8.48-fold increase in construction activity between 2017 and 2025 indicates a significant expansion of the domestic market for construction materials. This creates favorable conditions for manufacturers to increase production capacity, diversify product portfolios and improve supply-chain efficiency.

Investment is one of the principal drivers of production capacity and technological efficiency. According to the Association “Uzsanoatqurilishmateriallari,” investment projects in the construction materials sector have been aimed at increasing production capacities, introducing modern technologies and creating new jobs [19]. For Andijan Region, investment in cement, thermal insulation materials, concrete products and other high-value-added materials can contribute to structural modernization.

Construction materials manufacturing is generally characterized by relatively high energy and raw-material intensity. Therefore, production efficiency should be measured not only through output growth but also through:

- energy consumption per ton of output;
- raw-material consumption per unit of product;
- water consumption;
- production waste;
- transportation costs;
- percentage of recycled materials.

Energy-efficient kilns, automated dosing systems, heat recovery, waste recycling and digital production control can substantially improve resource efficiency.

Growth in output does not automatically mean growth in economic efficiency. If labor costs and administrative expenses increase faster than production output, enterprise efficiency may decline. Therefore, enterprises should systematically monitor: output per employee; value added per employee; labor cost per unit of output; machine downtime; defective-product ratio; production cost per unit.

The development of cooperation among raw-material suppliers, construction-material manufacturers, logistics companies, construction firms, universities and research institutions can improve regional efficiency. A regional construction-materials cluster can be represented as:

Raw materials → Processing → Construction materials → Logistics → Construction → Recycling

Such integration can increase local value added, reduce transportation costs and promote technological cooperation.

⁷ Author's calculations based on [2; 3; 12].

Based on the empirical results, an integrated production-efficiency model is proposed (Figure 3).

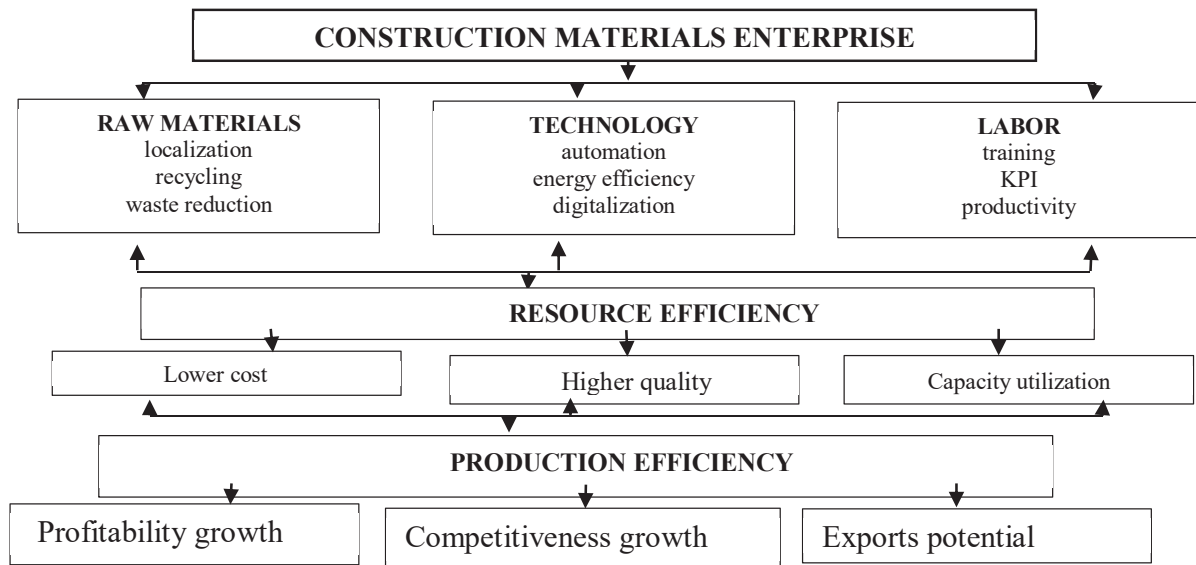


Figure 3. Integrated model of production-efficiency improvement⁸

The model emphasizes that production efficiency should be evaluated through the entire chain from resource utilization to financial and market outcomes.

CONCLUSIONS AND SUGGESTIONS

Based on the analysis, the following recommendations are proposed for construction materials manufacturing enterprises in Andijan Region.

Introduce digital production monitoring. Enterprises should establish real-time monitoring of: production output; electricity consumption; natural gas consumption; raw-material consumption; equipment downtime; defective products.

Introduce energy-efficiency KPIs. Energy consumption per ton of finished product should become one of the principal management indicators.

Increase the utilization of local raw materials. The share of locally sourced mineral raw materials should be increased while production waste should increasingly be used as secondary raw material.

Expand high-value-added products. Enterprises should diversify beyond traditional cement, concrete and bricks toward: thermal insulation materials; autoclaved aerated concrete; dry construction mixtures; decorative construction materials; advanced reinforced concrete products; modern wall materials.

Develop a regional construction-materials cluster. Andijan Region should develop a cluster based on the principle:

**raw materials – processing – construction materials – logistics –
construction – recycling.**

Establish an integrated efficiency index. An enterprise-level integrated efficiency index can be introduced:

$$IE=0.25*P+0.2*C+0.2*E+0.15*K+0.1*Q+0.1*I$$

This index would enable managers to evaluate efficiency from multiple dimensions rather than relying solely on production volume.

The analysis demonstrates that the construction materials manufacturing sector in Andijan Region experienced substantial nominal growth during 2017–2025. First, total industrial output increased from UZS 13,269.8 billion in 2017 to UZS 107,885.0 billion in 2025, representing an approximately 8.13-fold increase. Second, the substantial increase in cement production indicates expanding production capacity and increasing market activity in the region. Third, the future development of the construction materials industry should

⁸ Source: Developed by the author.

increasingly shift from extensive growth toward intensive efficiency improvements. Accordingly, the strategic priorities for construction materials manufacturing enterprises in Andijan Region should include: reducing energy consumption per unit of output; increasing labor productivity; improving production-capacity utilization; expanding high-value-added products; increasing the utilization of local raw materials; introducing digital production-management systems; reducing production waste; developing industrial clusters; improving product quality; strengthening competitiveness in domestic and export markets.

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