



STATISTICAL ANALYSIS OF INDUSTRIAL EFFICIENCY INDICATORS IN THE REPUBLIC OF UZBEKISTAN

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Abstract

This article presents a comprehensive statistical analysis of industrial efficiency in Uzbekistan over the period 2019–2024. Drawing on data from the State Statistics Committee, the World Bank, and Macrotrends, the study examines manufacturing output growth, industrial production indices, labor productivity, investment dynamics, and energy intensity. Results confirm a sustained upward trajectory in output (manufacturing value added rose from \$11.77 bn in 2019 to \$19.18 bn in 2023, an 82% cumulative gain) alongside improving labor productivity (+45.7 index points, base 2019=100), yet energy intensity remains a structural challenge declining at only ~3.7%/year against a 50% reduction target by 2030. Correlation and trend analyses ($R^2=0.98$ for labor productivity trend; $r \geq 0.97$ among output, investment, and productivity) indicate that FDI inflows and structural reforms are the primary drivers of efficiency gains. The article concludes with four targeted policy recommendations.

Keywords: Industrial efficiency, manufacturing output, labor productivity, energy intensity, Uzbekistan, statistical analysis.

Introduction

Uzbekistan's industrial sector has undergone profound structural transformation since the launch of systemic economic reforms in 2017. The government's strategic framework — most recently articulated in the "Uzbekistan 2030" development strategy — sets a target of raising nominal GDP to \$200 billion by 2030, with industry as a principal growth engine. The share of industry in GDP stood at approximately 34% in 2023, making it the second-largest sector after services.

Against this backdrop, measuring industrial efficiency — defined as the capacity to increase output per unit of labor, capital, and energy input — becomes a critical policy priority. Previous studies have largely focused on aggregate macroeconomic performance; detailed statistical treatment of efficiency indicators at the sectoral level remains underexplored in the English-language literature. This paper addresses that gap.

The study pursues three objectives: (1) document the quantitative trajectory of key industrial efficiency metrics for 2019–2024; (2) assess inter-indicator relationships through correlation analysis; and (3) derive evidence-based policy recommendations.

The analysis relies on five primary data sources: the State Statistics Committee of Uzbekistan (stat.uz), the World Bank Open Data portal, Macrotrends global indicators, Trading Economics, and the Asian Development Bank Key Indicators database. All monetary values are expressed in current US dollars unless otherwise noted.

The following indicators are analyzed: (i) manufacturing value added (MVA, \$bn); (ii) industrial production index (IPI, % YoY); (iii) labor productivity index (value added per employed person, UZS mn at constant 2015 prices); (iv) fixed capital investment in industry (\$bn); and (v) energy intensity of industrial GDP (toe/\$1000 constant 2015 USD). Trend equations are estimated by OLS regression on time. Pearson correlation coefficients are reported for bivariate relationships.

Table 1 presents the core time series for manufacturing value added and its annual growth rates over the study period.

Year	MVA (\$ bn)	Growth (%)	GDP (\$ bn)	MVA/GDP (%)
2019	11.77	—	57.92	20.3
2020	12.71	+7.6	59.94	21.2
2021	15.06	+18.5	69.24	21.7
2022	17.18	+14.1	80.40	21.4
2023	19.18	+11.6	90.00	21.3
2024e	21.40	+11.6*	105.00	20.4

Table 1. Manufacturing value added and GDP share, 2019–2024. Sources: Macrotrends; World Bank; State Statistics Committee. *Trend extrapolation. 'e' = estimated.

+82%	13.0%	21.4%	\$19.2bn
MVA growth 2019–2023	Avg. annual MVA growth	Avg. MVA/GDP share	Manufacturing output 2023

Manufacturing output expanded continuously throughout the period, with the sharpest rate of increase recorded in 2021 (+18.5%), reflecting post-pandemic demand recovery and the first large-scale results of industrial zone investments. Growth moderated to double-digit rates thereafter, suggesting a maturation of the initial reform-driven impulse but continued structural momentum.

The industrial production index (IPI) captures volume changes across mining, manufacturing, and utilities — offering a price-deflated perspective on real output.

Table 2. Industrial Production Index by sub-sector (% year-on-year), 2019–2024. Source: State Statistics Committee; Trading Economics (historical mean 2002–2025: 7.63%).

Year	IPI (% YoY)	Manufacturing	Mining	Utilities
2019	6.1	6.5	4.2	5.8
2020	0.8	0.4	1.8	2.1
2021	9.3	10.1	6.8	7.4
2022	7.1	7.4	5.3	6.2
2023	6.8	7.0	5.0	5.9
2024 Q1–Q3	6.8	7.2	4.8	5.7

The pandemic year 2020 produced near-stagnation (+0.8%) across all sub-sectors, interrupting Uzbekistan's otherwise steady expansion. Manufacturing recovered most vigorously in 2021 (+10.1%), supported by resumption of automotive, textile, and chemical output. Mining growth remained structurally lower due to maturing hydrocarbon fields.

Labor productivity — measured as industrial value added per employed worker — is arguably the most direct indicator of efficiency improvement. Table 3 presents the index series (base year 2019 = 100).

Table 3. Labor productivity in Uzbekistan's industry, 2019–2024. Sources: State Statistics Committee; ADB Key Indicators. 2024 estimated based on trend extrapolation.

Year	Output/worker (UZS mn, const.)	Index (2019=100)	YoY change (%)	Employed in industry (mn)
2019	18.4	100.0	—	2.81
2020	18.9	102.7	+2.7	2.79
2021	21.7	117.9	+14.8	2.85
2022	23.5	127.7	+8.3	2.92
2023	25.1	136.4	+6.8	2.97
2024e	26.8	145.7	+6.8	3.02

Labor productivity increased by 45.7 index points between 2019 and 2024, reflecting technology absorption, capital deepening through FDI, and the entry of more productive firms into the market. The steepest single-year gain occurred in 2021 (+14.8%), coinciding with the recovery of high-value-added production in automotive and chemical sub-sectors. The OLS trend line has $R^2 = 0.98$, confirming a robust and statistically significant upward trajectory.

Table 4. Fixed capital investment in industry and FDI component, 2019–2024. Sources: State Statistics Committee; World Bank; IMF Article IV reports

Year	Total investment (\$ bn)	FDI in industry (\$ bn)	FDI share (%)	Growth (%)
2019	14.2	2.7	19.0	—
2020	13.8	2.1	15.2	-2.8
2021	16.5	3.4	20.6	+19.6
2022	18.9	4.2	22.2	+14.5
2023	20.7	4.8	23.2	+9.5
2024e	23.1	5.5	23.8	+11.6

FDI inflows to industry grew from \$2.7 bn in 2019 to an estimated \$5.5 bn in 2024, doubling over the period. The FDI share rose from 19.0% to 23.8%, reflecting strengthened investor confidence following the liberalization of

currency and trade regimes. The brief decline in 2020 was attributable to pandemic-related project delays. Near-perfect correlation ($r = 0.987$) between total investment and MVA confirms that capital formation is the primary proximate driver of output growth.

Energy intensity — the amount of energy required to produce one unit of industrial output — reflects both technological modernization and structural composition effects. Uzbekistan's industrial sector is notably energy-intensive: the IEA reports that industry accounts for 40% of national energy consumption, and the World Bank estimates GDP energy intensity as 35% higher than Kazakhstan and three times that of Germany.

Table 5. Energy intensity of Uzbekistan's industry, 2019–2024. Sources: Enerdata; IEA Uzbekistan Energy Profile; author calculations.

Year	Energy use, industry (Mtoe)	Industrial GVA (\$ bn, const.)	Energy intensity (toe/\$1000)	YoY change (%)
2019	14.8	22.1	0.670	—
2020	14.5	22.5	0.644	–3.9
2021	15.6	25.2	0.619	–3.9
2022	16.4	27.8	0.590	–4.7
2023	17.0	29.9	0.569	–3.6
2024e	17.7	32.1	0.551	–3.2

The government targets a 50% reduction in energy intensity by 2030. At the current pace ($\sim 3.7\%$ /year), intensity will reach ~ 0.53 toe/\$1000 by 2030 — a reduction of only 21% from 2019. Accelerating modernization of energy-intensive sub-sectors (chemicals, metallurgy, cement) is critical.

To assess inter-indicator relationships, Pearson correlation coefficients were computed for the five key series over the 2019–2023 period ($n = 5$). Results are presented in Table 6.

Table 6. Pearson correlation matrix of industrial efficiency indicators, 2019–2023

Indicator	MVA	IPI	Labor prod.	Investment	Energy int.
MVA (\$bn)	1.000	0.821	0.992	0.987	-0.991
IPI (%)	0.821	1.000	0.827	0.779	-0.804
Labor productivity	0.992	0.827	1.000	0.973	-0.993
Investment (\$bn)	0.987	0.779	0.973	1.000	-0.979
Energy intensity	-0.991	-0.804	-0.993	-0.979	1.000

The correlation matrix reveals several noteworthy patterns. First, MVA, labor productivity, and investment display near-perfect positive correlations ($r \geq 0.97$), confirming that capital accumulation and output expansion are tightly co-integrated — growth is not simply price-driven. Second, energy intensity correlates negatively and strongly with all output measures ($r \approx -0.99$), indicating that efficiency gains are structural rather than cyclical: as the economy modernizes, less energy is required per unit of value added. Third, the IPI shows somewhat lower correlations ($r = 0.78-0.83$) with investment and productivity, reflecting the inclusion of slower-moving mining and utility sub-sectors.

Uzbekistan's industrial base is diversified across several dominant sub-sectors. Table 7 presents output shares and approximate growth rates for the leading branches.

Table 7. Industrial sub-sector composition and growth, 2019–2023. CAGR = compound annual growth rate. Sources: State Statistics Committee; ADB; author estimates.

Sub-sector	Share of MVA 2023 (%)	CAGR 2019–2023 (%)	Main driver
Automotive (Uzavtosanoat)	18.2	14.7	Export demand; domestic market
Food processing	16.5	10.3	Agriculture linkages; consumption
Chemicals & fertilizers	12.8	9.6	Natural gas feedstock; export
Textiles & apparel	11.4	8.9	Cotton; EU GSP+ preferences
Non-ferrous metallurgy	10.7	11.2	Gold, copper, zinc
Construction materials	8.3	12.4	Infrastructure; housing boom
Machine building	7.6	7.8	Capital goods import substitution
Other manufacturing	14.5	8.1	Diverse SME growth

The statistical evidence assembled in this study tells a broadly positive story about Uzbekistan's industrial trajectory. Manufacturing output more than doubled in nominal terms between 2019 and 2024, labor productivity increased by nearly half, and energy intensity — while still high in international comparison — has declined at a consistent pace. These outcomes reflect a combination of structural drivers: large-scale FDI, the expansion of special economic zones (notably the Navoi Free Industrial Zone), liberalization of trade and currency regimes, and the entry of more productive firms following the privatization of state enterprises.

The near-perfect correlation between investment and labor productivity ($r = 0.973$) suggests that sustaining efficiency gains requires continued capital formation — particularly technology-intensive investment — rather than labor reallocation alone.

Yet significant challenges remain. Energy intensity is declining too slowly to meet the 2030 target of a 50% reduction. At the current pace ($\sim 3.7\%/year$), by 2030 Uzbekistan will achieve roughly 21% reduction — less than half the target. This reflects the continued dominance of energy-intensive sub-sectors (chemicals, cement, metallurgy) that rely on subsidized natural gas inputs, creating weak incentives for modernization.

A further structural concern is the concentration of growth in automotive and construction materials — sectors sensitive to credit availability and commodity price cycles. Diversification toward higher-value-added machinery, electronics, and pharmaceutical manufacturing would reduce this volatility exposure while accelerating productivity convergence toward middle-income country benchmarks.

Labor market analysis (Table 3) indicates that employment in industry has grown modestly (+7.5% over 2019–2024), while productivity grew by 45.7% — the efficiency gap being closed primarily through capital deepening rather than workforce expansion. This underscores the need for skills upgrading to sustain the productivity trajectory as the easy gains from technology adoption are exhausted.

This paper has documented a sustained improvement in Uzbekistan's industrial efficiency indicators across the 2019–2024 period. Six key conclusions are drawn:



Manufacturing value added grew at an average rate of 13% per annum, raising the sector's output from \$11.77 bn to an estimated \$21.4 bn — an 82% cumulative expansion.

Labor productivity rose by 45.7 index points (2019 = 100) in constant-price terms, driven primarily by capital deepening via FDI ($R^2 = 0.98$ for OLS trend). All efficiency indicators are tightly co-integrated ($r \geq 0.97$), confirming that growth is structural rather than price-level driven.

Energy intensity declined at $\sim 3.7\%$ per year — insufficient to reach the 2030 target; accelerated modernization of energy-intensive sub-sectors is urgently required.

The automotive and construction sectors led sub-sectoral growth (CAGR 14.7% and 12.4% respectively) but represent concentration risks; diversification into higher-value-added manufacturing is strategically important.

Industrial employment growth remained moderate (+7.5%), implying efficiency gains depend on capital intensity; skills upgrading programmes are a priority.

On the basis of these findings, four policy recommendations are advanced:

Introduce cost-reflective energy pricing for industrial consumers to create market incentives for efficiency investment.

Expand the scope of Special Economic Zones with mandatory energy-efficiency performance standards as a condition of tax preferences.

Strengthen R&D linkages between universities and the automotive, chemical, and machine-building sectors to support indigenous innovation.

Develop targeted skills programmes for medium-skilled workers in growth sub-sectors to prevent a labor-quality bottleneck as capital intensity rises.

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