Digital Modernization and Productivity-Labor Alignment at UzAuto Motors

A Descriptive Accounting Study, 2019-2024

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Abstract

This paper examines how documented digital and production modernization coincided with changes in partial productivity indicators, employment, and personnel expenditure at UzAuto Motors between 2019 and 2024. The evidence combines audited consolidated financial statements, the 2021 prospectus, interim reporting on the implementation of SAP S/4 HANA, disclosures on the Global Emerging Markets production platform, and a 2025 offering memorandum. Digitalization is observed through dated corporate events rather than a continuous technology-intensity variable; the study therefore applies a descriptive accounting decomposition and does not estimate a causal technology effect. The main indicators are nominal revenue per employee, vehicles sold per employee, employment, personnel expenditure per employee, and the personnel-cost-to-revenue ratio. The revised annual series includes the previously omitted 2022 observation. Between 2019 and 2024, year-end employment increased by 39.7 percent, nominal US-dollar revenue by 51.5 percent, and personnel expenditure by 70.6 percent. Nominal revenue per year-end employee rose by 8.4 percent, while personnel expenditure per year-end employee increased by 22.1 percent. Annual log decompositions show sharp contractions in 2020-2021, a recovery in 2022-2023, and renewed divergence in 2024. The 2024 interpretation is sensitive to the employment denominator: revenue per year-end employee was almost unchanged, but revenue per average employee declined by 11.2 percent. Vehicles sold per year-end employee increased by 13.3 percent from 2022 to 2024. The findings document co-movement during a modernization period, but they do not isolate technology from demand, prices, product mix, exchange rates, capacity utilization, or changes in the consolidation perimeter. Employment and personnel expenditure are treated as a narrow observable economic block relevant to productive employment, not as a complete measure of decent work.

Keywords: digital modernization; partial productivity; employment; personnel expenditure; automotive firm; UzAuto Motors; Uzbekistan

JEL codes: D24, J24, J31, L62, O33

1. Introduction

Digital technologies affect manufacturing firms through enterprise resource planning, production scheduling, inventory control, quality assurance, data integration, and the reorganization of tasks. Their measured output effects depend on complementary managerial and intangible investments, and they may emerge with a delay (Bloom, Sadun, and Van Reenen, 2012; Brynjolfsson, Rock, and Syverson, 2021). Automation and organizational change can also alter task composition and labor demand rather than producing a uniform employment response (Autor, 2015; Acemoglu and Restrepo, 2019).

This paper examines these relationships in a single, systemically important manufacturing group: UzAuto Motors. The case is relevant because the reporting period covers the implementation of SAP S/4 HANA from January 2021, investment in the Global Emerging Markets (GEM) platform, new-model development, equipment and capacity expansion, and substantial changes in sales and employment. The available disclosures establish a modernization timeline, but they do not provide annual measures of digital capital, automation intensity, robot density, or worker exposure.

The study therefore asks a narrower positive question: how did partial productivity indicators, employment, and personnel expenditure co-move during the documented modernization period? The analysis does not equate revenue per employee with total factor productivity, personnel expenditure with wages, or the personnel-cost-to-revenue ratio with labor's share of value added. Each measure is interpreted according to its accounting content.

The paper contributes an auditable annual reconstruction for 2019-2024, including the 2022 observation omitted in the earlier draft, and applies an exact accounting decomposition to distinguish changes in revenue, headcount, and

personnel expenditure. The contribution is descriptive rather than causal: the evidence identifies timing, co-movement, denominator sensitivity, and reporting limitations that must be addressed before stronger claims about technology and productivity can be made.

2. Analytical Framework and Empirical Questions

The analysis separates three layers. The modernization layer records dated digital and production events. The firm-performance layer uses nominal revenue per employee and vehicles sold per employee as partial indicators. The observable labor layer uses employment and personnel expenditure. These labor variables capture a narrow economic dimension related to productive employment, but they do not measure rights at work, occupational safety, working time, social dialogue, social protection, training quality, or wage distribution.

Table 1. Analytical Structure

Layer	Observed content	Indicators	Interpretive limit
Modernization	Dated organizational and production events	SAP S/4 HANA; GEM investment; equipment and capacity disclosures	No continuous technology-intensity measure
Firm performance	Partial commercial and physical indicators	Nominal revenue per employee; vehicles sold per employee	Not total factor productivity; sales are not production
Observable labor outcomes	Scale and employer-side personnel expenditure	Year-end and average employment; personnel expenditure per employee; personnel-cost-to-revenue ratio	Not wages, welfare, or a complete decent-work measure
Context and reporting	Demand, prices, exchange rates, product mix, group perimeter	Corporate notes and consolidation disclosures	Confounding factors cannot be eliminated

Source: Author's analytical specification.

Let R denote nominal revenue, E year-end employment, P personnel expenditure, q = R/E nominal revenue per year-end employee, c = P/E personnel expenditure per year-end employee, and m = P/R the personnel-cost-to-revenue ratio.

$$R_t = E_t \, x \, q_t \quad (1)$$

$$P_t = E_t \, x \, c_t \quad (2)$$

$$m_t = P_t / R_t = c_t / q_t \quad (3)$$

The annual descriptive accounting gap is defined using logarithmic changes:

$$A_t = Delta\ ln(q_t) - Delta\ ln(c_t) = -Delta\ ln(m_t) \quad (4)$$

A positive value means that nominal revenue per employee grew faster than personnel expenditure per employee; a negative value means the reverse. Because employment cancels algebraically, A is an exact transformation of the change in the personnel-cost-to-revenue ratio, not an independent welfare or productivity index.

For denominator robustness, average employment is calculated as:

$$Ebar_t = (E_{t-1} + E_t) / 2 \quad (5)$$

Empirical questions

- How did nominal revenue, employment, and personnel expenditure change annually during 2019-2024?
- Did nominal revenue per employee and personnel expenditure per employee move synchronously, and how did the personnel-cost-to-revenue ratio change?
- Are conclusions about per-employee performance robust to year-end versus average employment and to a physical sales indicator?
- Could changes in the consolidation perimeter affect the interpretation of group-level employment movements?

3. Data, Source Audit, and Measurement

The empirical unit is the consolidated UzAuto Motors group. Revenue and personnel expenditure are annual flows in millions of US dollars. Employment is reported at year-end. Personnel expenditure is reconstructed as payroll-related costs reported in cost of sales, general and administrative expenses, and selling expenses. Vehicle sales are used as a separate physical sales indicator for 2022-2024.

Table 2. Source Audit Trail

Period/item	Corporate source	Location	Use
2019 revenue	UzAuto Motors 2019 audited consolidated statements	Statement of profit or loss, internal p. 2	Revenue baseline
2019-2020 employment	UzAuto Motors 2021 Prospectus	Historical company information, PDF p. 109	Year-end headcount
2020-2021 revenue and payroll	2021 audited consolidated financial statements	Note 1, pp. 11-12; Notes 20-23, pp. 32-33	Revenue, employment, personnel expenditure

Period/item	Corporate source	Location	Use
2021 SAP event	Interim consolidated financial statements, H1 2021	Note 1, p. 8	Modernization timeline
2022-2023 data	2023 audited consolidated financial statements	Statement p. 7; Note 1 p. 11; Notes 22-25 pp. 36-37	Revenue, employment, personnel expenditure
2024 data and perimeter	2024 audited consolidated financial statements	Statement p. 7; Note 1 pp. 10-11; Notes 22-25 pp. 32-33	Revenue, employment, personnel expenditure, ownership changes
GEM investment	Interim H1 2023 financial statements	Note 8, pp. 14-15	Production-modernization context
Vehicle sales, 2022-2024	UzAuto Motors 2025 Offering Memorandum	Operating statistics section	Physical sales indicator

Source: UzAuto Motors corporate documents. The 2019 personnel-expenditure total is retained from the audited-source reconstruction used in the original data worksheet and is reported rounded to one decimal million US dollars.

Table 3. Corporate Indicators, 2019-2024

Indicator	2019	2020	2021	2022	2023	2024
Year-end employment, persons	10,904	11,225	11,196	14,144	16,511	15,234
Revenue, USD million	2,798.9	2,623.6	2,162.3	3,298.3	4,609.6	4,239.6
Personnel expenditure, USD million	89.8	87.8	88.7	118.0	136.0	153.2
Nominal revenue / year-end employee, USD thousand	256.69	233.72	193.13	233.20	279.18	278.30
Personnel expenditure / year-end employee, USD thousand	8.24	7.82	7.93	8.34	8.23	10.06
Personnel-cost-to-revenue ratio, %	3.21	3.35	4.10	3.58	2.95	3.61

Source: Author's calculations from the documents listed in Table 2. Values may differ slightly from the earlier draft because 2022 is now included and audited payroll components are summed explicitly.

The term 'personnel expenditure' is used throughout. It includes employer-side payroll-related costs and is not equivalent to cash wages, disposable income, or average earnings. The ratio P/R is called the personnel-cost-to-revenue ratio; it is not labor's share of value added.

Table 4. Consolidation-Perimeter Events Relevant to Employment Interpretation

Year	Reported event	Accounting status	Interpretive implication
2020	R&D Center and UzLogistic were added; Avtosanoat-Injiniring was acquired; Asaka Automotive Plant was liquidated.	Changes in subsidiaries under consolidation	The 2019-2020 headcount change may include perimeter effects.
2022	Control over UzLogistic was transferred; the company became an associate.	No longer consolidated line by line	Part of the 2022 headcount movement may reflect deconsolidation.
2023	Three non-core subsidiaries were transferred to state authorities.	Removed from the consolidated group	The employment effect is not separately disclosed and cannot be quantified.
2024	Ownership in Avtosanoat-Injiniring decreased from 98.01% to 97.64%; UzLogistic associate share decreased from 47.30% to 32.24%.	Control over Avtosanoat-Injiniring retained; UzLogistic remained an associate	Ownership dilution does not by itself establish workforce restructuring.

Source: UzAuto Motors audited consolidated financial statements for 2021, 2023, and 2024.

4. Results

4.1. Documented Modernization Timeline

The modernization evidence has an event-based form. SAP S/4 HANA was implemented on 1 January 2021. GEM-related expenditure covered new models, a welding workshop, equipment, and production-capacity expansion. Sustainability disclosures linked digitalization and new processes to operational efficiency. These events establish a chronology, but they do not yield a continuous technology variable or a counterfactual firm.

Table 5. Technology and Organization Events

Period	Documented event	Permissible interpretation
2021	SAP S/4 HANA ERP implementation	Enterprise-wide digital integration event

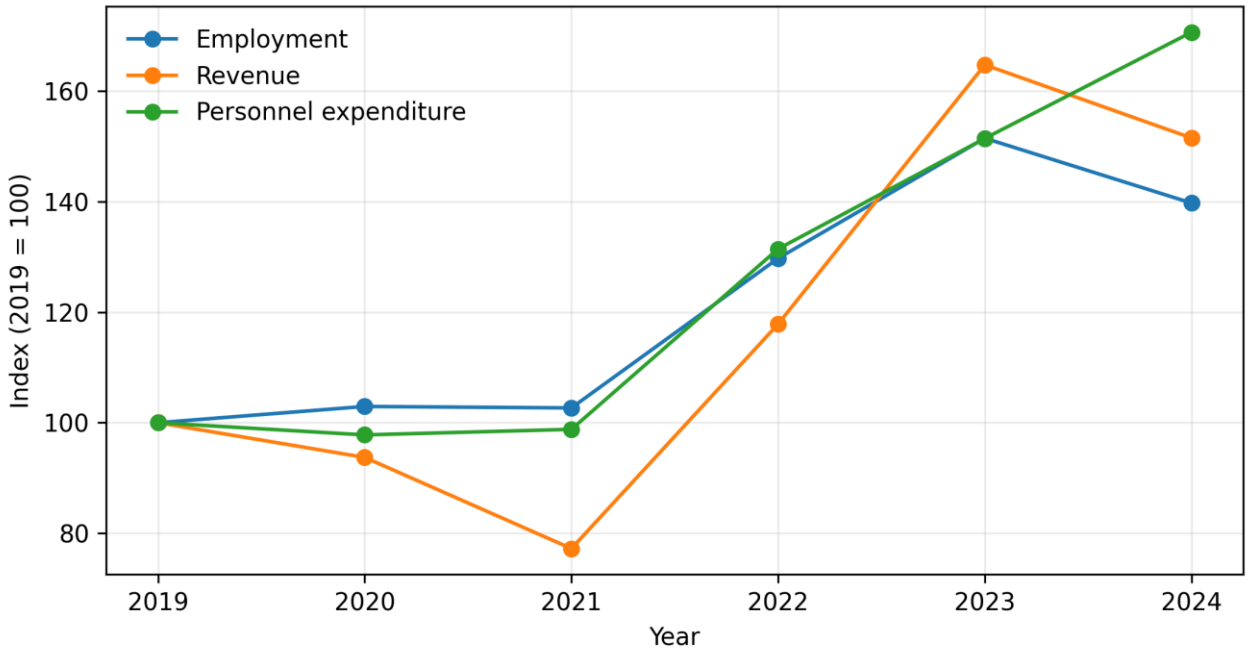
Period	Documented event	Permissible interpretation
2021-2024	GEM model development, welding facilities, equipment, and capacity expenditure	Production-modernization and investment context
2022 onward	Sustainability disclosures refer to digitalization and process efficiency	Qualitative organizational evidence
2019-2024	Large annual changes in revenue, employment, payroll costs, and product mix	Requires separation from technology claims

Source: UzAuto Motors (2021 interim statements; 2023 interim statements; sustainability disclosures).

4.2. Scale, Revenue, and Personnel Expenditure

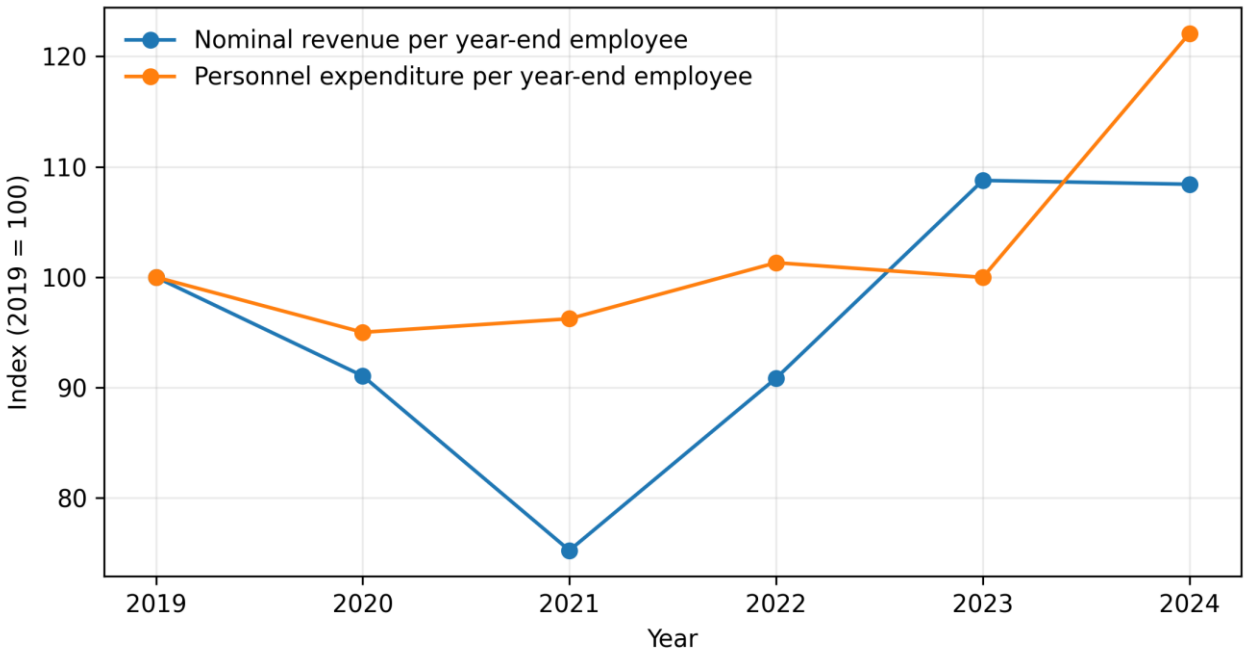
Between 2019 and 2024, year-end employment increased from 10,904 to 15,234 persons, or by 39.7 percent. Nominal US-dollar revenue increased by 51.5 percent and personnel expenditure by 70.6 percent. Nominal revenue per year-end employee rose from USD 256.69 thousand to USD 278.30 thousand, while personnel expenditure per year-end employee rose from USD 8.24 thousand to USD 10.06 thousand. The personnel-cost-to-revenue ratio increased from 3.21 to 3.61 percent.

Figure 1. Employment, Revenue, and Personnel Expenditure, 2019-2024



Source: Author's calculations; indexed values, 2019 = 100.

Figure 2. Nominal Revenue and Personnel Expenditure per Year-End Employee



Source: Author's calculations; indexed values, 2019 = 100.

4.3. Annual Accounting Decomposition

The complete annual series changes the phase interpretation. The strongest negative gaps occurred in 2021 and 2024, when personnel expenditure per year-end employee grew faster than nominal revenue per employee. Positive gaps in 2022 and 2023 reflected faster revenue growth relative to payroll-related expenditure. These are accounting co-movements, not estimates of technology effects.

Table 6. Annual Log Changes and Descriptive Accounting Gap

Year	Revenue	Year-end employment	Nominal revenue / employee	Personnel expenditure / employee	Gap A	Personnel-cost / revenue
2020	-6.47	2.90	-9.37	-5.13	-4.25	3.35%
2021	-19.33	-0.26	-19.08	1.28	-20.36	4.10%
2022	42.22	23.37	18.85	5.14	13.71	3.58%
2023	33.47	15.47	18.00	-1.32	19.32	2.95%
2024	-8.37	-8.05	-0.32	19.99	-20.30	3.61%

Source: Author's calculations. Changes are 100 x annual log differences. The gap equals the log change in nominal revenue per employee minus the log change in personnel expenditure per employee.

In 2020, nominal revenue per employee declined more rapidly than personnel expenditure per employee. In 2021, the negative gap widened as revenue fell sharply while personnel expenditure was broadly maintained. The 2022 and 2023 recoveries produced positive gaps of 13.71 and 19.32 log points, respectively. In 2024, nominal revenue per year-end employee was almost unchanged, whereas personnel expenditure per year-end employee increased by about 20 log points, producing a negative gap of 20.30 log points.

4.4. Employment-Denominator Robustness

Annual revenue and personnel expenditure are flows, whereas year-end headcount is a stock. To test denominator sensitivity, the analysis also divides annual flows by the arithmetic mean of adjacent year-end employment levels. This robustness check materially changes the 2024 interpretation.

Table 7. Per-Employee Measures Using Average Employment

Year	Average employment	Revenue / average employee, USD thousand	Personnel expenditure / average employee, USD thousand
2020	11,064.5	237.11	7.94
2021	11,210.5	192.88	7.91
2022	12,670.0	260.33	9.31
2023	15,327.5	300.74	8.87
2024	15,872.5	267.10	9.65

Source: Author's calculations. Average employment equals the mean of opening and closing year-end headcount.

Using year-end employment, nominal revenue per employee changed from USD 279.18 thousand in 2023 to USD 278.30 thousand in 2024. Using average employment, it declined from USD 300.74 thousand to USD 267.10 thousand, or by 11.2 percent. Personnel expenditure per average employee increased by 8.8 percent. The claim that 2024 per-employee performance was stable is therefore not robust to the employment denominator and is not retained as a general conclusion.

4.5. Vehicle Sales per Employee

Vehicle sales provide a physical robustness indicator for 2022-2024. The measure avoids nominal price and exchange-rate movements but remains a sales indicator rather than a production measure. Inventory changes can separate sales from output.

Table 8. Vehicle Sales per Year-End Employee, 2022-2024

Year	Vehicle sales, units	Year-end employment	Vehicles sold per employee
2022	324,947	14,144	22.97
2023	410,350	16,511	24.85
2024	396,581	15,234	26.03

Source: Author's calculations from UzAuto Motors (2025 Offering Memorandum) and audited employment disclosures.

Vehicles sold per year-end employee increased from 22.97 in 2022 to 26.03 in 2024, or by 13.3 percent. This result shows higher sales intensity relative to year-end headcount. It does not demonstrate an equivalent increase in production capacity or total factor productivity.

5. Discussion

The evidence establishes a sequence of corporate changes that coincided with a documented modernization program. SAP integration, GEM investment, model renewal, and capacity expenditure occurred alongside large movements in revenue and employment. The available data do not identify how much of those movements was generated by technology rather than demand, prices, exchange rates, product mix, supply constraints, inventories, or capacity utilization.

The revised annual series also demonstrates why productivity claims depend on measurement. Nominal revenue per year-end employee recovered strongly in 2022-2023, while personnel expenditure per employee grew more slowly. In 2024, the year-end denominator suggests a flat revenue ratio, but the average-employment denominator indicates a decline. The physical sales ratio increased over 2022-2024, but sales are not identical to production. A robust firm-productivity assessment would require real value added, capital input, intermediate inputs, product-level prices, and consistent average labor input.

The observable labor results are correspondingly narrow. Higher personnel expenditure per employee may reflect wages, bonuses, social contributions, changes in occupational composition, severance, or other employee-related costs. It does not show how gains were distributed across workers. Employment changes may also reflect alterations in the consolidation perimeter. The paper therefore avoids describing the results as a complete assessment of decent work.

The descriptive accounting gap is useful for organizing the time series, but it is not a new structural model. Its value is transparency: the measure shows exactly when nominal revenue and personnel expenditure moved at different rates and makes clear that the result is equivalent to the change in the personnel-cost-to-revenue ratio.

6. Limitations

- The study concerns one consolidated group and cannot be generalized mechanically to the entire automotive industry or its supplier network.
- Technology is measured by dated events and qualitative disclosures, not by annual digital-capital or automation intensity.
- Nominal US-dollar revenue per employee is affected by prices, exchange rates, product mix, imports, and intermediate-input costs.
- Vehicle sales per employee measure sales intensity, not production or value added.
- Year-end and average employment are imperfect measures of annual labor input; hours worked and occupational composition are unavailable.
- Personnel expenditure includes several employer-side cost categories and is not equivalent to wages or disposable employee income.
- Changes in the consolidation perimeter may affect reported headcount, and the employment effects of transferred entities are not disclosed.

- Public reporting does not provide consistent annual series for working time, safety, training, turnover, collective bargaining, gender pay differences, or social protection.

7. Conclusion

This paper reconstructed an annual 2019-2024 series linking UzAuto Motors' documented modernization period with partial productivity indicators, employment, and personnel expenditure. The inclusion of audited 2022 data removes the artificial break in the earlier draft and reveals two successive recovery years, 2022 and 2023, followed by a different configuration in 2024.

Over the full period, nominal revenue and personnel expenditure increased faster than year-end employment. Nominal revenue per year-end employee rose by 8.4 percent, personnel expenditure per year-end employee by 22.1 percent, and the personnel-cost-to-revenue ratio from 3.21 to 3.61 percent. Annual log decompositions show negative revenue-personnel expenditure gaps in 2020, 2021, and 2024 and positive gaps in 2022 and 2023.

The 2024 result highlights the importance of denominator choice: nominal revenue per year-end employee was nearly unchanged, whereas revenue per average employee declined. Vehicle sales per year-end employee increased over 2022-2024, but the measure remains a sales ratio. The evidence therefore documents co-movement during a modernization period without attributing the observed changes to digitalization.

A stronger test of the firm-technology relationship would require plant- or line-level data on digital investment, automation, capital, real output, labor hours, occupational composition, training, and comparable firms. The present study provides a transparent descriptive baseline for that work and maintains a clear boundary between what the corporate reports support and what they do not.

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