

THE RENEWAL–DEPRECIATION PARADOX IN RAILWAY FIXED ASSETS AND ITS IMPLICATIONS FOR PREDICTIVE MAINTENANCE

Xolbutaeva Shakhnoza Abduvalievna

PhD in Economics, Associate Professor

Tashkent State University of Economics

e-mail: sh.xolbutayeva@tsue.uz

Introduction. The technical condition of fixed assets is the area where digital monitoring and predictive maintenance systems generate the most direct economic value. It is conventionally described by two indicators — the renewal coefficient and the depreciation coefficient — which are expected to move in opposite directions: intensive renewal should reduce the accumulated wear of the asset base. The aim of this study is to examine the joint dynamics of these indicators at Uzbekistan Railways JSC and to assess their suitability for evaluating digitalization.

Methods. Target and actual values of the indicators were taken from the company's performance analyses for 2020 and 2022 [1; 2]; the normative threshold for depreciation was taken from the 2021 business plan, which sets it below 0.5 [3]. Fleet data for 2017–2020 were drawn from the company's basic statistics [4]. At the enterprise level, the depreciation coefficient of Quyuvmexanika zavodi JSC was calculated as the ratio of accumulated depreciation to the gross book value of fixed assets using its annual report [5].

Table 1.

Fixed asset and rolling stock indicators¹

Indicator	Earlier value	Later value	Target / norm
Renewal coefficient (2020 → 2022)	0.968	0.954	0.150
Depreciation coefficient (2020 → 2022)	0.375	0.452	0.250; norm < 0.5
Locomotives on the books (2017 → 2020)	544	481	—
Active locomotives (2017 → 2020)	484	391	—
Share of active locomotives, % (2017 → 2020)	89.0	81.3	—
Rolling stock maintenance in total costs, %	6.82	5.35	—
Depreciation, Quyuv-mexanika zavodi (2022 → 2023)	0.557	0.600	norm < 0.5

Results. In 2022 the renewal coefficient exceeded its target more than sixfold, yet the depreciation coefficient rose from 0.375 to 0.452 and exceeded its own target by 80.8%. The physical data point in the same direction: the number of active locomotives fell by almost one fifth, reducing their share in the fleet from 89.0% to 81.3%, while the share of rolling stock maintenance in total costs declined steadily. At the enterprise level, the depreciation coefficient of Quyuv-mexanika zavodi reached 0.600 in 2023, above the company's normative threshold.

Discussion. The simultaneous growth of renewal and depreciation constitutes a paradox that admits two interpretations. Renewal may be concentrated in selected asset classes while the rest of the asset base continues to age, so that aggregate indicators conceal strong heterogeneity. Alternatively, the result may be definitional: a renewal coefficient close to one is atypical under the standard definition — newly commissioned assets divided by the total asset base — which suggests that the company applies a different calculation base. In either case the aggregate indicator

¹ Source: author's calculations based on [1–5].

cannot be used as a reliable measure of asset condition without clarifying its methodology.

Both interpretations point to the same practical conclusion. Aggregate balance-sheet indicators do not capture the condition of individual assets, while the declining share of active locomotives shows that failures are already constraining operations. This is exactly the information gap that asset-level monitoring and predictive maintenance systems close: they replace averaged indicators with data on the condition of each unit and allow maintenance resources to be directed where failure risk is highest. The economic value of such systems is greatest precisely under a shrinking maintenance budget and an ageing fleet.

The paradox has direct consequences for composite evaluation frameworks. When both indicators are included in the same technological block and normalized against the company's own targets, the renewal coefficient reaches the maximum normalized value of 1.0, while the depreciation coefficient receives only 0.553. The two indicators thus send contradictory signals within one block, and their average conceals the problem instead of revealing it. A framework that relies on such indicators without examining their joint behaviour risks presenting an ageing asset base as a well-maintained one.

Two methodological remedies follow. First, fixed-asset indicators should be disaggregated by asset class — locomotives, wagons, track and signalling equipment — since renewal and wear may differ radically across these groups. Second, balance-sheet indicators should be complemented by physical ones, such as the share of active rolling stock and the frequency of unscheduled repairs, which are less sensitive to accounting conventions. Both remedies depend on the availability of asset-level data, which again points to monitoring systems as a precondition for reliable evaluation rather than merely as an object of investment.

Conclusion. The renewal–depreciation paradox reveals the limits of aggregate fixed-asset indicators for assessing railway digitalization. Their use in evaluation frameworks requires a transparent calculation methodology, and effective asset management requires asset-level data of the kind generated by predictive maintenance systems [6].

References

1. Uzbekistan Railways JSC. Key performance indicators (KPI) for 2020 [in Uzbek]. — URL: <https://railway.uz/uz/proekty/25808/>
2. Uzbekistan Railways JSC. Analysis of key and additional performance indicators for 2022 [in Uzbek]. — URL: <https://railway.uz>
3. Uzbekistan Railways JSC. Business plan for 2021, section 12 «Key performance indicators» [in Uzbek].
4. Uzbekistan Railways JSC. Basic operational and financial statistics, 2017–2020.
5. Quyuv-mexanika zavodi JSC. Annual issuer report for 2023 [in Uzbek]. — URL: <https://openinfo.uz>
6. Xolbutaeva Sh.A. Scientific and methodological foundations for assessing the institutional-economic mechanism of railway digitalization: monograph [in Uzbek]. — Tashkent: Modern Science and Research, 2026. — 212 p.