DEVELOPING AN EFFICIENCY EVALUATION SYSTEM FOR THE NATIONAL LOGISTICS ECOSYSTEM

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Abstract: This paper addresses the problem of evaluating the performance efficiency of the national digital logistics ecosystem. The purpose of the study is to integrate indicators that currently exist in isolation at the module level into a single, multi-criteria, hierarchically aggregated efficiency evaluation model. As a result of the study, a four-component evaluation system comprising, operational, economic, quality-and-reliability, institutional-managerial, and international-competitiveness indicator groups is proposed, together with a methodology for aggregating them into a single composite index.

Keywords: logistics ecosystem, efficiency evaluation, composite index, Balanced Scorecard, Logistics Performance Index.

Introduction

The transport and logistics sector is one of the most important branches of Uzbekistan's national economy. According to the State Statistics Committee, in 2025 a total of 1.601 billion tons of cargo was carried by all modes of transport in the country, of which approximately 90 percent (1.434 billion tons) was accounted for by road transport, while freight turnover reached 84.0 billion ton-kilometers. These figures illustrate the scale of the sector, yet no unified and systematic mechanism currently exists to evaluate how efficiently the system as a whole is operating.

In recent years, the digitalization of Uzbekistan's transport and logistics sector has accelerated, and a concept for a National Digital Freight Transport and Logistics Ecosystem — encompassing modules such as a Freight Exchange, Electronic Logging Device (ELD), Weight Station, electronic Bill of Lading (e-BOL), AI Analytics, a National Trust Index, digital insurance, and billing — is being developed. Each module within this concept has its own proposed set of key performance indicators (KPIs). However, practice shows that module-level, isolated indicators do not allow decision-makers — whether the management of an individual company or state authorities — to draw a systemic conclusion about the efficiency of the ecosystem as a whole. This raises a question that is highly relevant from the standpoint of management theory and practice: how can dispersed operational indicators be integrated into

a unified evaluation system suitable for supporting managerial decisions?

The purpose of this study is to develop a multi-criteria, hierarchically aggregated model — together with an implementation methodology — that makes it possible to evaluate the performance efficiency of the national logistics ecosystem at levels ranging from the individual module to the system as a whole.

Research Methodology

The study employs a systems approach, comparative analysis, and multi-criteria evaluation methods. The methodological foundation is the Balanced Scorecard concept developed by R. Kaplan and D. Norton, which allows organizational performance to be evaluated not only in financial terms but across several interrelated dimensions. This concept was adapted to the specific characteristics of the national logistics ecosystem and applied in the following sequence.

In the first stage, the KPIs proposed for each module (the National Rating and Trust system, digital insurance, electronic payment and billing, and others) within the concept of the National Digital Freight Transport and Logistics Ecosystem were collected and classified using content analysis. In the second stage, indicators with similar content were logically grouped into four broad dimensions. In the third stage, a weighted-sum method was substantiated for normalizing the indicators within each group onto a common scale and aggregating them into a single composite index, with group weighting coefficients recommended to be determined through expert judgment methods (e.g., the Delphi method or the Analytic Hierarchy Process — AHP).

The data sources envisaged for the study are the digital modules within the ecosystem (Freight Exchange, ELD, Weight Station, e-BOL, AI Analytics, Trust Index, digital insurance, and billing) as well as official reports of the State Statistics Committee. The diversity of these data sources ensures that the evaluation system is organizationally and technically feasible, since all indicators are already designed to be collected automatically through the modules envisaged in the ecosystem's architecture.

Results

As a result of the analysis, a four-component indicator system was developed for evaluating the efficiency of the national logistics ecosystem.

1. Operational-economic efficiency group. This group includes the vehicle utilization ratio, the reduction in the share of empty miles, fuel consumption optimization, the alignment of average freight rates with market levels, and the share of shipments delivered on time. International experience shows that AI-based routing can reduce empty miles by 15–30 percent; this figure was adopted as a benchmark value for the operational group.

2. Quality and reliability group. This group is based on the indicators proposed within the National Trust Index system — the share of companies with a high Trust Index score (above 80 points), the reduction in the number of customer complaints, the Customer Satisfaction Score, and the decline in the number of unreliable or unlicensed carriers.

3. Institutional-managerial group. This group includes the share of electronic document flow (e-BOL, electronic invoices, electronic insurance policies), the share of operations completed through automated settlement and Smart Claim processes, the degree of automation of regulatory control, and the speed of information exchange among state authorities. These indicators were formulated on the basis of the KPIs proposed for the digital insurance and billing modules (share of electronic policies, average payment processing time, reduction in insurance fraud cases).

4. International competitiveness group. This group covers Uzbekistan's position in the World Bank's Logistics Performance Index (LPI), the volume of transit freight flows, the growth rate of logistics service exports, and indicators of the country's leadership in digital logistics within the Central Asian region.

Based on the four indicator groups, it is proposed that a single National Logistics Ecosystem Efficiency Index (NLEEI) be formed in the following generalized form: NLEEI = w1·I(operational) + w2·I(quality) + w3·I(institutional) + w4·I(international), where I(·) denotes the normalized index (ranging from 0 to 1) for each group, and w1...w4 are weighting coefficients — determined through expert evaluation and summing to 1. This structure allows the index to be applied at any level of management — an individual carrier company, a region, or the country as a whole.

The implementation stages were aligned with the overall rollout timeline envisaged in the concept: in 2026–2027, the database required for collecting and normalizing the indicators will be established; in 2028–2030, the group indices and initial weighting coefficients will be piloted; and in 2031–2035, the NLEEI will be calculated in near real time, fully automated, with the support of an AI analytics module.

Discussion And Conclusion

The proposed model differs from existing approaches in several respects. First, the World Bank's Logistics Performance Index ranks countries only once every two years, based on external expert surveys, and is therefore not sufficiently timely to inform internal operational decisions. The proposed NLEEI, by contrast, relies on data collected automatically from the ecosystem's modules, enabling near-real-time monitoring, and can be applied using the same methodology at the micro (company), meso (regional), and macro (national) levels.

Second, the model links the planning and control functions of management by translating dispersed, module-level KPIs into a higher-level managerial decision-support instrument — without discarding those underlying indicators — which constitutes the model's principal scientific and practical contribution.

At the same time, the practical implementation of the model is subject to certain limitations. In particular, the determination of weighting coefficients may remain dependent on the subjective judgments of the expert panel, and the quality and completeness of the underlying data will improve gradually as the modules are rolled out in stages. For this reason, it is recommended that the NLEEI first be piloted on a limited scale — in a selected region or group of companies — with the weighting coefficients periodically reviewed and adjusted in light of the results obtained.

In conclusion, to address the problem of evaluating efficiency within the national logistics ecosystem, a four-component, multi-level evaluation model has been developed that integrates operational-economic, quality-and-reliability, institutional-managerial, and international-competitiveness indicators. The implementation of this model would enable state authorities and business structures to continuously monitor the performance of the ecosystem, to make managerial decisions on a data-driven basis, and to strengthen the international competitiveness of Uzbekistan's transport and logistics system.

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