INTEGRAL ASSESSMENT OF PUBLIC PROCUREMENT EFFICIENCY BASED ON HYBRID WEIGHTING

Axmedjanov Sardorbek
PhD in Economics, Independent Researcher, Tashkent State University of Economics

Abstract. This thesis presents a multi-criteria methodology for the integral assessment of public procurement efficiency. It proposes evaluating efficiency not solely through price savings, but also through institutional, economic, competitive, entrepreneurial, digitalization, transparency, and contract-performance indicators. A hybrid weighting approach combining Shannon entropy and the Analytic Hierarchy Process (AHP) is substantiated for determining indicator weights.

Keywords: public procurement, efficiency, composite index, Shannon entropy, AHP, hybrid weighting, normalization.

Assessing public procurement efficiency solely through the difference between initial and final contract prices does not fully reflect the actual performance of the procurement system. A contract concluded at a low price may subsequently be associated with poor-quality performance, delays, or additional costs. Conversely, procurement with relatively modest price savings may generate higher quality, local innovation, or broader social outcomes. Therefore, a comprehensive framework capable of jointly evaluating fiscal, institutional, and strategic results is required.

The proposed integral assessment model evaluates public procurement efficiency across ten modules: institutional, organizational, economic, competition, entrepreneurship, e-procurement, transparency, contract performance, environmental and social outcomes, and overall effectiveness. It is recommended that each module include 3-5 indicators, resulting in a total set of approximately 30-50 indicators.

To ensure comparability among indicators expressed in different units of measurement, min-max normalization is applied. Benefit-type indicators, for which higher values imply improved performance, and cost-type indicators, for which higher values indicate deterioration, are normalized separately within the [0,1] interval.

One of the key methodological issues in constructing a composite index is the determination of indicator weights. Weighting based exclusively on expert judgment may increase subjectivity, whereas purely statistical weighting may understate indicators that are economically or institutionally important but display limited variation. For this reason, a hybrid weighting approach is proposed.

Shannon entropy captures the statistical discriminatory power of indicators and derives objective weights from the amount of information contained in the data. AHP, in turn, incorporates the economic and strategic significance of indicators through pairwise expert comparisons. Combining these two approaches integrates statistical objectivity with expert knowledge and thereby improves the methodological balance of the assessment system.

In the baseline specification, the final weight is calculated as $w_i = 0.5w_i^E + 0.5w_i^A$, assigning equal shares to entropy-based and AHP-based weights. To ensure the internal consistency of expert judgments within AHP, the consistency ratio must satisfy the condition $CR < 0.10$.

The proposed composite index ranges from 0 to 1. Values of 0.00-0.20 are interpreted as very low performance, 0.21-0.40 as low, 0.41-0.60 as satisfactory, 0.61-0.75 as good, 0.76-0.90 as high, and 0.91-1.00 as benchmark performance. Such a classification enables not only comparisons across regions or procuring entities but also the identification of specific modules in which performance is weak.

© 2026 London International Monthly Conference on Multidisciplinary Research and Innovation. All Rights Reserved.

An important advantage of the hybrid model is its ability to compensate for the limitations of individual weighting methods. An institutionally important indicator with low variability may receive a small entropy weight, while AHP preserves its strategic relevance. Conversely, if experts assign excessive importance to conventional indicators, entropy-based weighting introduces balance by reflecting actual statistical differentiation in the data.

The use of a hybrid-weighted composite index for the comprehensive assessment of public procurement efficiency makes it possible to summarize system performance in a single measure while simultaneously diagnosing problematic areas. Applying the methodology across regions, public procuring entities, and procurement categories can strengthen evidence-based decision-making in public procurement management. In practical implementation, it is essential to conduct regular sensitivity analysis of weights, assess data quality, examine correlations among indicators, and verify the stability of the methodology over time.

References

1. OECD. Public Procurement Performance. OECD Publishing, 2023.
2. OECD, European Union, JRC. Handbook on Constructing Composite Indicators. OECD Publishing, 2008.
3. Shannon, C. E. “A Mathematical Theory of Communication.” Bell System Technical Journal, 1948, 27, 379–423.
4. Saaty, T. L. The Analytic Hierarchy Process. McGraw-Hill, 1980.
5. Diakoulaki, D., Mavrotas, G., & Papayannakis, L. “The CRITIC Method.” Computers & Operations Research, 1995, 22(7), 763–770.

© 2026 London International Monthly Conference on Multidisciplinary Research and Innovation. All Rights Reserved.