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Faks: +998 (75) 221 1395
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Адрес редакции:
180100, г. Карши, ул. Мустакиллик, дом 225

Тел: +998 (75) 221 09 23
+998 (93) 902 72 63
Факс: +998 (75) 221 1395
E-mail: innoeconomic@kstu.uz

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WEIGHTS, STAFF NUMBERS AND CATEGORY LEADERS: HOW UZBEKISTAN'S NATIONAL RANKING SCORES RESEARCH OUTPUT

Mamajonova Mukhlisakhon Muzaffar kizi

VAZNLAR, PROFESSOR-O'QITUVCHILAR SONI VA TOIFA YETAKCHILARI: MILLIY REYTINGDA ILMIY NASHRLAR QANDAY BAHOLANADI

Mamajonova Muxlisaxon Muzaffar qizi

ВЕСА, ЧИСЛЕННОСТЬ ПРЕПОДАВАТЕЛЕЙ И ЛИДЕРЫ КАТЕГОРИЙ: КАК НАЦИОНАЛЬНЫЙ РЕЙТИНГ ОЦЕНИВАЕТ НАУЧНЫЕ ПУБЛИКАЦИИ

Мамажонова Мухлисахон Музаффар кизи

Annotatsiya. Maqolada O'zbekiston oliy ta'lim tashkilotlari milliy reytingidagi ilmiy nashrlar indikatori baholangan. Indikator Scopus bazasidagi Top 1% va Top 10% toifalaridagi hamda Q1-Q4 jurnallaridagi maqolalarni 12, 10, 8, 6, 4 va 1 vaznlar bilan birlashtiradi, natijani professor-o'qituvchilar soniga bo'ladi va toifa yetakchisiga nisbatan ballga aylantiradi. 2025-yil bo'yicha 105 ta oliy ta'lim tashkilotining rasmiy ma'lumotlari asosida bir-birini qoplaydigan vaznlar Q1 jurnalidagi bitta Top 1% maqolaga 30 vazn birligi berishi, nashrlarning 18,6 foizi esa kvartilga ega emasligi ko'rsatilgan. Muqobil vaznlar oliy ta'lim tashkilotlarining o'rnini kam o'zgartiradi: professor-o'qituvchiga to'g'ri keladigan nashrlar sonining o'zi rasmiy ballar bilan $\rho = 0{,}935$ darajada bog'liq. Bitta qo'shimcha Q1 maqolaning qiymati bir toifa ichida 89 baravargacha farq qiladi, amaliy va tibbiyot toifalarida esa har o'nta tashkilotdan taxminan to'qqiztasi maksimal ballning 10 foizidan kam oladi. Rasmiy hisobotda tilga olingan logarifmik me'yorlashtirish qo'llanganida amaliy toifadagi median ball 0,072 o'rniga 0,730 bo'lar edi. Maqolada har bir maqolani bir marta hisoblash, professor-o'qituvchilar soni bo'yicha minimal chegara, yetakchiga kamroq bog'liq me'yorlashtirish indikator komponentlarini alohida e'lon qilish hamda indikator surati va maxrajini bir xil asosda belgilash taklif etiladi.

Kalit so'zlar: ilmiy nashrlar indikatori, Scopus, kompozit indikator, vaznlash, me'yorlashtirish, milliy reyting.

Аннотация. В статье оценивается индикатор научных публикаций национального рейтинга высших образовательных учреждений Узбекистана. Индикатор объединяет статьи Scopus в категориях Top 1% и Top 10% по цитируемости и в журналах квартилей Q1-Q4 с весами 12, 10, 8, 6, 4 и 1, делит результат на численность профессорско-преподавательского состава и переводит его в баллы относительно лидера категории. На основе официальных данных по 105 вузам за 2025 год показано, что пересекающиеся веса дают одной статье из Top 1% в журнале Q1 30 весовых единиц, а 18,6% публикаций не имеют квартиля. Альтернативные веса мало меняют положение вузов: одно лишь число публикаций на одного преподавателя коррелирует с официальными баллами на уровне $\rho = 0{,}935$. Ценность одной дополнительной статьи Q1 внутри категории различается до 89 раз, а в прикладной и медицинской категориях около девяти из десяти вузов получают менее 10% максимального балла. При логарифмической нормализации, упомянутой в официальном отчёте, медианный балл в прикладной категории составил бы 0,730 вместо 0,072. Предлагается учитывать каждую статью один раз, ввести минимальный порог численности преподавателей, использовать нормализацию, меньше зависящую от лидера, публиковать компоненты индикатора отдельно, а также согласованно определить числитель и знаменатель индикатора.

Ключевые слова: индикатор научных публикаций, Scopus, композитный индикатор, взвешивание, нормализация, национальный рейтинг.

Abstract. The article evaluates the research output indicator of Uzbekistan's national ranking of higher education institutions. The indicator combines Scopus papers in the Top 1% and Top 10% citation percentiles and in Q1-Q4 journals with weights of 12, 10, 8, 6, 4 and 1, divides the result by the number of academic staff and converts it into points relative to the category leader. Using official data for 105 institutions in 2025, the study shows that the overlapping weights give one Top 1% paper in a Q1 journal 30 weight units, while 18.6% of publications have no quartile. Alternative weights change institutional ranks little: the number of publications per staff member alone correlates with official scores at $\rho = 0.935$. The value of one additional Q1 paper differs by up to 89 times within a

category, and in the Applied and Medical categories about nine in ten institutions receive less than 10% of the maximum score. Under the logarithmic normalisation mentioned in the official report, the median score in the Applied category would be 0.730 instead of 0.072 points. The article proposes counting each paper once, a minimum staff threshold, a normalisation that depends less on the leader, separate publication of the indicator's components and a consistent definition of its numerator and denominator.

Keywords: research output indicator, Scopus, composite indicator, weighting, normalisation, national university ranking.

INTRODUCTION

Research output has become one of the main dimensions on which Uzbek higher education institutions are compared. In the national ranking of higher education institutions, research output is measured by the indicator of articles published in journals indexed in the Scopus database (National Agency for Quality Assurance in Education, 2026). The indicator does not count publications equally. It combines six components with different weights: papers in the Top 1% and Top 10% of world citation percentiles, and papers in journals of the first to fourth quartiles (Q1 to Q4). The weighted sum is divided by the number of academic staff, and the result is converted into points within each institutional category.

The design of such a composite indicator matters because it determines what institutions are rewarded for. Research on performance-based research funding shows that institutions respond quickly to the rules that link output to money and status (Butler, 2003; Hicks, 2012). From 1 January 2027, Presidential Decree No. PF-58 introduces financial incentives based on national ranking results (President of the Republic of Uzbekistan, 2026). Each design choice in the research output indicator will therefore have a direct financial consequence for universities.

The official analytical report on the 2025 results explains the formula and notes that the categories overlap: a paper in the Top 1% is also counted in the Top 10%, and every paper with a known quartile is also counted in one of the Q1 to Q4 components, so that a Top 1% paper in a Q1 journal contributes 30 weight units (Suleymanov, Mullaev and Mahkamov, 2026). The report describes the results of each institution, but it does not analyse how the components of the indicator, the staff denominator and the normalisation rule shape institutional scores.

The aim of this article is to evaluate, at the level of individual institutions, how the weighting structure, the staff-based denominator and the normalisation rule of the research output indicator determine institutional scores. The article asks four questions: how much of the indicator comes from citation-based components and how much from journal quartiles; how sensitive institutional ranks are to the weights, including the overlap between components; how the staff denominator affects the value of a publication; and how the normalisation rule distributes points within categories.

LITERATURE REVIEW

The use of bibliometric indicators in research evaluation has a long and critical literature. The Leiden Manifesto states that quantitative evaluation should support, not replace, expert assessment, and that indicators should take account of differences between fields (Hicks et al., 2015). The San Francisco Declaration on Research Assessment recommends that journal-based metrics should not be used as a surrogate measure of the quality of individual articles (DORA, 2013). Both documents caution against indicators that reward the venue of publication more than its content.

The research output indicator of the national ranking is a composite indicator that combines two kinds of measures. Citation percentiles, such as the Top 1% and Top 10%, are article-level measures that compare the citations of each paper with those of comparable papers, usually papers of the same publication year and, in field-normalised versions, the same field (Bornmann, Leydesdorff and Mutz, 2013). Journal quartiles are journal-level measures that describe the position of the journal in its field, not the impact of the article. A composite indicator that adds both kinds of measures rewards the same paper twice when it is both highly cited and published in a high-quartile journal.

The literature on composite indicators shows that design choices can change results considerably. The OECD and JRC handbook identifies normalisation, weighting and aggregation as the steps that most influence outcomes and recommends sensitivity analysis before an index is used in policy (OECD and JRC, 2008). Paruolo, Saisana and Saltelli (2013) show that the nominal weights of an index may differ greatly from the actual importance of its components, because importance also depends on the variation of each component and on the correlation between them. A component with a high weight but little variation contributes little to the final ranking.

Normalisation deserves the same attention as weighting. The OECD and JRC handbook describes several normalisation methods, including ranking, standardisation, ratio to a reference value and transformations of the original scale, and notes that they can lead to different results (OECD and JRC, 2008). A review of composite indices shows more generally that methodological choices in their construction affect the final ranking and therefore need robustness checks (Greco et al., 2019). Ratio-to-maximum normalisation is simple and transparent, but it ties every score to a single extreme value. Saisana, d'Hombres and Saltelli (2011) show that the positions of many universities in global rankings change considerably when such methodological assumptions are varied within plausible limits, and conclude that comparisons between individual universities are not robust to these choices.

A further issue is the denominator. Indicators that divide output by staff numbers are intended to make large and small institutions comparable, but productivity measures depend strongly on how the inputs, including staff, are defined and counted (Abramo and D'Angelo, 2014). Size-independent indicators are also subject to

greater statistical uncertainty for small units, because an average based on few papers can change considerably when a few papers are added (Waltman, 2016). Experience with publication-based funding formulas shows that the incentives created by an indicator may shift effort towards whatever the formula counts. In Australia, a formula based on publication counts was followed by a rise in output, mainly in lower-impact journals (Butler, 2003).

Comparative studies of performance-based research funding show that national systems differ in what they count and in how directly results are linked to money. Hicks (2012) distinguishes systems based on peer review from systems based on indicators, shows that most systems combine the two, and argues that their influence comes largely from the competition for prestige they create. The Norwegian publication indicator, which was designed to allocate a small share of funding between institutions, came to be used locally by institutions, faculties and departments for purposes beyond its original design (Aagaard, 2015). This experience is directly relevant to Uzbekistan: once a national indicator is linked to institutional finance, its formula is likely to be copied into internal performance systems, so that its design properties reach individual academics. Unlike the systems described by Butler (2003) and Aagaard (2015), the Uzbek indicator has three specific features: it combines article-level and journal-level measures, it divides output by staff numbers and it scales points to the best institution in each category. Each of these features has been discussed separately in the literature, but their combined effect in a national ranking has not been examined.

These studies suggest that the effects of the Uzbek research output indicator depend not only on the weights but also on the overlap between components, the staff denominator and the normalisation rule. These elements have not been examined empirically for the Uzbek national ranking at the level of individual institutions. The present article addresses this gap by treating the national indicator as a composite indicator and testing its weighting, denominator and normalisation separately, following the approach recommended for composite indicators (OECD and JRC, 2008).

RESEARCH METHODOLOGY

The study is quantitative and deductive: it starts from the formula defined in the regulation and tests how its elements behave when applied to real institutional data. The research design is a cross-sectional secondary analysis of official data for 2025. The data come from the analytical report "Research publication activity and international citation impact of higher education institutions (Scopus, 2025)" published by the National Agency for Quality Assurance in Education (Suleymanov, Mullaev and Mahkamov, 2026). The report gives, for each institution with a Scopus organisation profile, the number of academic staff, the total number of publications, the numbers of Top 1% and Top 10% papers, the numbers of papers in Q1 to Q4 journals, the index value and the points awarded. Scopus data were retrieved on 30 June 2026.

The sample consists of the 105 institutions for which both a Scopus profile and staff data are available. Of these, 102 receive points on the indicator in four categories: Applied (28), Medical (9), Social-Humanitarian (62) and Creative/Sport (3). The three local universities in the top 1,000 of international rankings form a separate category and receive no points on this indicator; they are used only in the descriptive analysis. Institutions without a Scopus profile receive zero points and are outside the analysis. The values were transcribed into a structured dataset, and the index values and points were recalculated from the published counts. The recalculation reproduces the published values for every institution, with a maximum difference of 0.005 for the index and 0.0005 for the points, and the totals of academic staff (51,357) and publications (18,424) coincide with those given in the report.

The research output index is defined as

$$K = \frac{12T_1 + 10T_2 + 8T_3 + 6T_4 + 4T_5 + T_6}{T_p} \quad (1)$$

where T1 and T2 are the numbers of papers in the Top 1% and Top 10% of citation percentiles, T3 to T6 are the numbers of papers in Q1 to Q4 journals and Tp is the number of academic staff working in their main position or as internal part-time staff (National Agency for Quality Assurance in Education, 2026). Under the official normalisation, points are calculated as Bi = (Ki/Km) × Bt, where Km is the highest index value in the category and Bt is the maximum score: 5 points in the Applied and Medical categories, 3 in the Social-Humanitarian category and 2 in the Creative/Sport category.

The analysis has five steps. First, the weighted numerator of each institution is divided into three parts: the citation-based part (Top 1% and Top 10%), the high-quartile part (Q1 and Q2) and the low-quartile part (Q3 and Q4). The average weight per publication is calculated as the numerator divided by the total number of publications. Second, scores are recalculated under four alternative schemes: without the double counting of Top 1% papers in the Top 10% component, with quartiles only, with citation percentiles only and with the simple number of publications. For each scheme, the Spearman rank correlation with official scores, the number of rank changes and the number of score changes greater than 0.25 points are recorded. Third, the marginal value of one additional Q1 paper is calculated for each institution as the change in points it would produce, holding the category maximum constant. Fourth, the distribution of points under the official rule is compared with a rule in which the second-highest index in the category is used as the scale and the leader is capped at the maximum score. Fifth, four alternative normalisation rules are applied to the same index values: the logarithmic rule ln(1 + Ki)/ln(1 + Km), the square-root rule √(Ki/Km), a ratio to the 90th percentile of the category with values above it capped at the maximum, and the percentile rank of the institution within its category. For each rule, the median score and the shares of institutions below 10% and at or above 50% of the maximum are recorded.

The alternatives were chosen so that each removes or changes one design element while keeping the others fixed. The scheme without overlap tests the effect of

counting Top 1% papers twice; the quartile-only and citation-only schemes test the contribution of each type of measure; the paper-count scheme removes all quality weights and therefore shows how much of the ranking is explained by volume per staff member alone. This one-at-a-time design makes it possible to attribute changes in results to a specific element, as recommended in uncertainty and sensitivity analysis of composite indicators (OECD and JRC, 2008; Saisana, d'Hombres and Saltelli, 2011). The normalisation rules were chosen to represent the main families discussed in the literature: a linear ratio to the maximum (the official rule), two concave transformations that reduce the effect of outliers (logarithmic and square root), a ratio to a high percentile instead of the maximum, and a rank-based rule (OECD and JRC, 2008). The logarithmic rule is included also because the official report refers to it.

The Spearman rank correlation is used because the ranking compares institutions by order within categories, and the statistic does not depend on the scale of the points. The threshold of 0.25 points is a practical measure of a noticeable change: it equals 5% of the maximum in the Applied and Medical categories and about 8% in the Social-Humanitarian category. Correlations are averaged over the Applied, Medical and Social-Humanitarian categories, and the Creative/Sport category is excluded from these comparisons, because three institutions with 16 publications are too few for a meaningful rank comparison. All calculations were made by the author in Python; the data and code are available from the author.

ANALYSIS AND MAIN RESULTS

Table 1 summarises the data by category. The 105 institutions employ 51,357 academic staff and have 18,424 publications in their Scopus profiles. Because a paper with several Uzbek affiliations is counted for each institution, this total is higher than the number of unique national publications. Of all institutional publications, 3,423, or 18.6%, have no journal quartile. Such papers add nothing to the index unless they are in the Top 10%. The share of unclassified papers is highest in the Social-Humanitarian category (24.9%).

Table 1.

Scopus publications and research output index by institutional category, 2025[9]

Category	n	Academic staff	Publications	Top 1%	Top 10%	Q1-Q2	Q3-Q4	No quartile, %	Median K	Maximum K
Applied	28	11,188	3,720	40	377	1,220	2,081	11.3	0.80	55.92
Medical	9	7,302	1,494	10	131	534	791	11.3	0.63	15.22
Social-Humanitarian	62	27,754	10,423	249	1,542	4,608	3,217	24.9	0.79	15.37
Creative/Sport	3	1,231	16	0	0	8	7	6.3	0.03	0.11
Top-1000 universities	3	3,882	2,771	34	327	1,166	1,369	8.5	3.48	7.50
Total	105	51,357	18,424	333	2,377	7,536	7,465	18.6	-	-

The median index is close to 0.8 in the Applied and Social-Humanitarian categories and 0.63 in the Medical category, but the maximum values are many times higher: 55.92 in the Applied category and about 15 in the Medical and Social-Humanitarian categories. The distribution of the index is therefore highly skewed within each category.

Table 2 shows how the overlapping weights translate into the weight of a single paper. A Q4 paper without high citation impact contributes one unit. A Q1 paper contributes eight units. A Top 10% paper in a Q1 journal contributes 18 units, and a Top 1% paper in a Q1 journal contributes 30 units, because it is counted in the Top 1%, Top 10% and Q1 components at the same time. A paper with no quartile contributes nothing unless it is in the Top 10%.

Table 2.

Weight units contributed by a single paper under the official formula[10]

Type of paper	Components in which it is counted	Weight units
Top 1% paper in a Q1 journal	Top 1%, Top 10%, Q1	30
Top 10% paper (not Top 1%) in a Q1 journal	Top 10%, Q1	18
Top 10% paper in a Q4 journal	Top 10%, Q4	11
Top 10% paper without a quartile	Top 10%	10
Q1 paper	Q1	8
Q2 paper	Q2	6
Q3 paper	Q3	4
Q4 paper	Q4	1
Paper without a quartile, not in the Top 10%	none	0

[9] Note: publications are counted in each institution's Scopus profile, so a paper with several institutional affiliations is counted more than once. Top-1000 universities are not scored on this indicator. Source: compiled by the author based on Suleymanov, Mullaev and Mahkamov (2026).

[10] Note: Top 1% papers are also Top 10% papers, and every paper with a known quartile is counted in one of the Q1-Q4 components. Source: compiled by the author based on National Agency for Quality Assurance in Education (2026) and Suleymanov, Mullaev and Mahkamov (2026).

At the institutional level, the average weight per publication ranges from 1.0 to 11.98, with a median of 4.47. The citation-based components account for a median of 20.4% of the weighted numerator, but for up to 59.1% in some institutions. In 55 of the 105 institutions, the low-quartile components (Q3 and Q4) contribute more to the numerator than the citation-based components. Figure 1 shows the composition of the numerator for the 15 institutions with the largest numbers of publications. The structures differ considerably: in some universities, the Top 1% and Top 10% components provide around 40% of the numerator, while in one institution, Q3 and Q4 journals provide more than half.

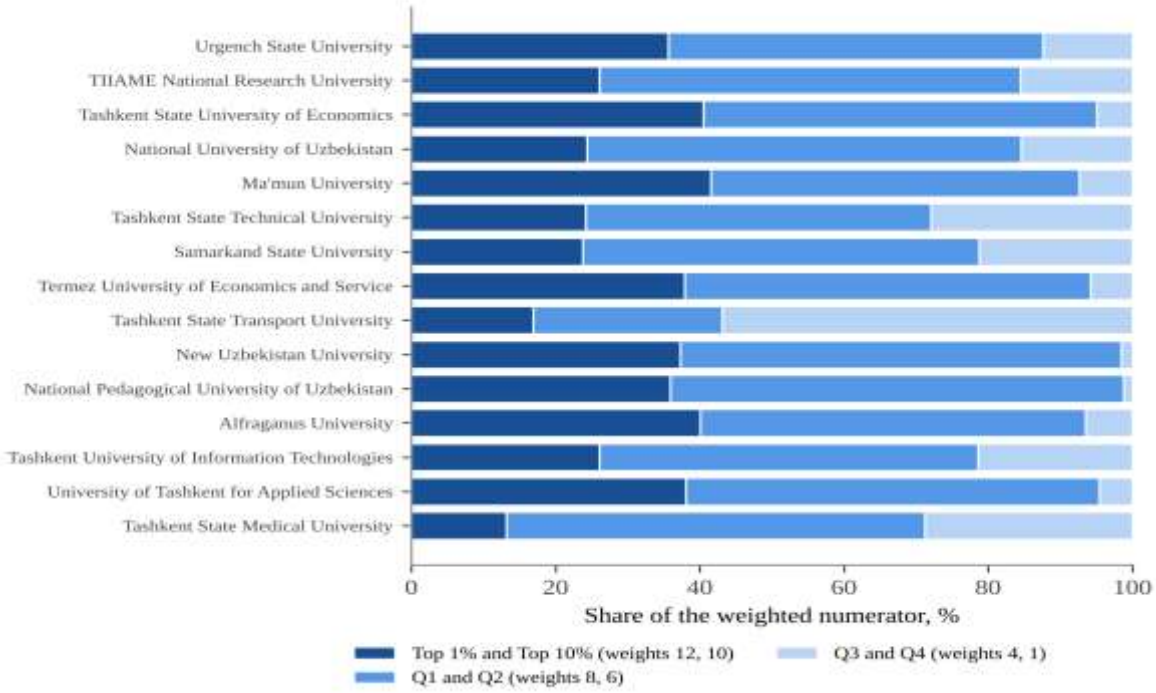


Figure 1. Composition of the weighted numerator in the 15 institutions with the largest numbers of Scopus publications, 2025[11]

Table 3 compares the official weighting with four alternative weighting schemes. Removing the double counting of Top 1% papers in the Top 10% component has almost no effect: the rank correlation with official scores is 0.999, 20 institutions change rank by at most two places, and no score changes by more than about 0.2 points. Using quartiles only gives a correlation of 0.977. Even the simple number of publications divided by staff numbers, which ignores quality altogether, gives a correlation of 0.935 with official scores. Only the scheme based on citation percentiles alone produces substantially different results (0.870), mainly because many institutions have no Top 10% papers. The comparison covers the 99 institutions of the Applied, Medical and Social-Humanitarian categories; the Creative/Sport category is excluded because none of its three institutions has Top 1% or Top 10% papers.

Table 3.

Sensitivity of institutional scores to alternative weighting schemes[12]

Scheme	Mean Spearman ρ with official scores	Institutions changing rank	Maximum rank shift	Institutions changing by more than 0.25 points	Max. change, points
Official formula	1.000	0	0	0	0.00
Without Top 1% counted again in Top 10%	0.999	20	2	0	0.20
Quartiles only (8, 6, 4, 1)	0.977	64	16	4	0.78
Citation percentiles only (12, 10)	0.870	86	21	13	1.11
Number of publications per staff member	0.935	86	23	19	1.21

[11] Source: author's calculations based on Suleymanov, Mullaev and Mahkamov (2026).

[12] Note: ranks and scores are calculated within categories for the Applied, Medical and Social-Humanitarian categories (n = 99 scored institutions); correlations are averaged over these three categories. The Creative/Sport category (3 institutions) is excluded because none of its institutions has Top 1% or Top 10% papers, so the citation-only scheme cannot be applied there. Source: author's calculations based on Suleymanov, Mullaev and Mahkamov (2026).

The category leaders are the same under the official scheme, the scheme without overlap and the quartile-only scheme. In the Social-Humanitarian category, the leader changes only when quality is ignored or when quartiles are ignored. These results are consistent with the argument of Paruolo, Saisana and Saltelli (2013) that nominal weights may differ from effective importance. The elaborate structure of the weights changes the order of institutions much less than its design suggests, probably because institutions that publish more per staff member also tend to have more papers in each component.

If the weights change the order of institutions relatively little, the index is driven mainly by the ratio of publications to staff. Figure 2 plots the index against staff numbers. There is no systematic relationship between size and index across institutions (in the Social-Humanitarian category, $\rho = 0.01$), but the highest values are concentrated among small institutions. The leader of the Applied category has 95 academic staff, the leader of the Medical category 89, and the second-ranked institution in the Social-Humanitarian category 19. The ten institutions with the highest index have a median of 96 academic staff, against 351 for all scored institutions.

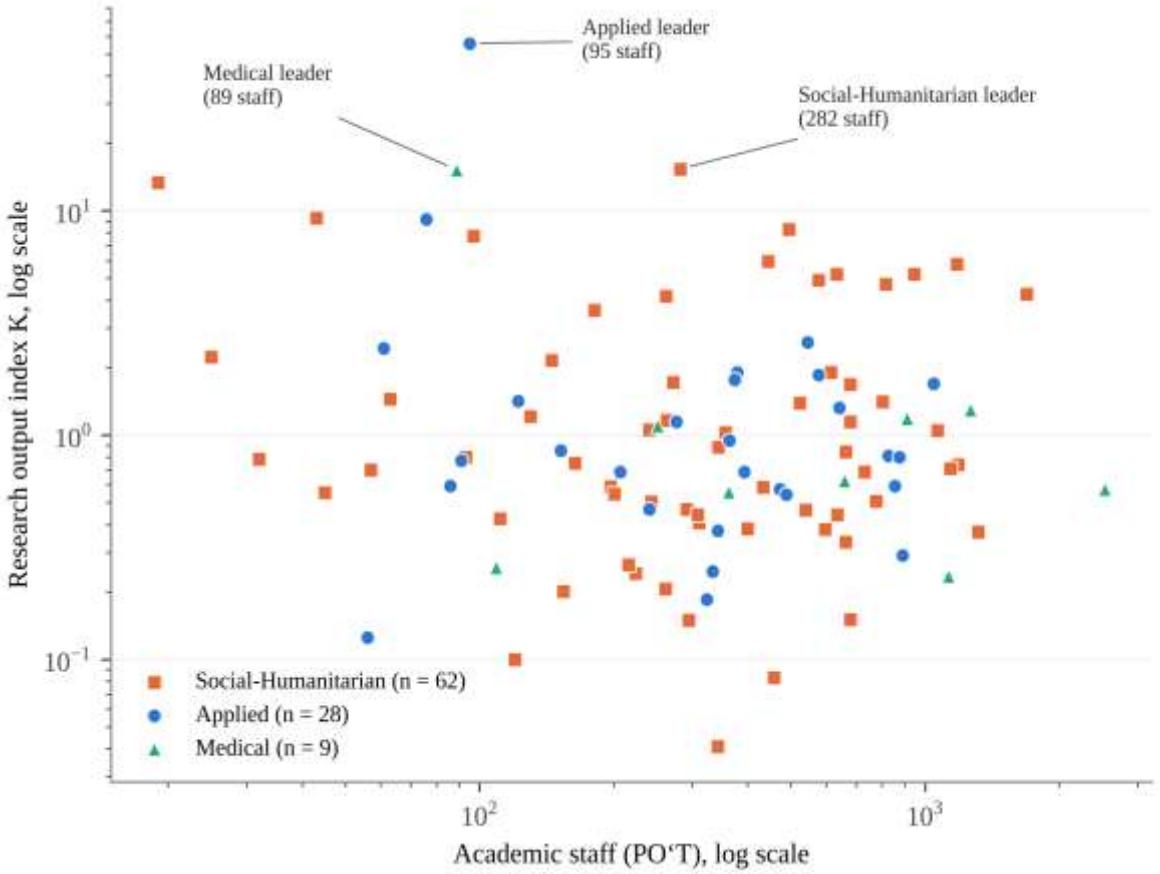


Figure 2. Research output index and number of academic staff, scored institutions, 2025 (n = 99)[13]

Because the weighted output is divided by staff numbers, the same paper has a very different value in different institutions. Within the Social-Humanitarian category, one additional Q1 paper is worth between 0.0009 and 0.0822 points, depending on the institution, a difference of almost 89 times. In the Applied category, the difference is about 19 times, and in the Medical category about 28 times. For a small institution, a few papers can move the score noticeably. For a large university, the same papers make almost no difference. This is related to the sensitivity of size-independent indicators for small units discussed by Waltman (2016).

The normalisation rule divides each index by the highest index in the category. Where the leader is far ahead of the rest, this compresses the scores of all other institutions. Table 4 shows that the leader of the Applied category has an index 6.1 times higher than the second institution, and the leader of the Medical category 11.7 times higher. As a result, 92.9% of Applied institutions and 88.9% of Medical institutions receive less than 10% of the maximum score, and the median scores are only 0.072 and 0.206 points out of 5. In the Social-Humanitarian category, the leader and the second institution are close (a ratio of 1.15), but 69.4% of institutions still receive less than 10% of the maximum.

[13] Note: the Creative/Sport category (3 institutions) is not shown. Source: author's calculations based on Suleymanov, Mullaev and Mahkamov (2026).

Table 4.

Category leaders and the distribution of points[14]

Category	Leader's staff	Leader's K	Second K	Ratio	Median score, points	Below 10% of maximum, %	Median score with second-highest K as scale
Applied (max. 5)	95	55.92	9.18	6.1	0.072	92.9	0.438
Medical (max. 5)	89	15.22	1.30	11.7	0.206	88.9	2.409
Social-Humanitarian (max. 3)	282	15.37	13.37	1.15	0.154	69.4	0.177

The sensitivity of points to the leader can be seen by using the second-highest index as the scale. In the Medical category, the median score would rise from 0.206 to 2.409 points, and no institution would remain below 10% of the maximum. In the Applied category, the median would rise from 0.072 to 0.438 points. In the Social-Humanitarian category, where the first two institutions are close, the effect is small. A single institution can therefore determine the scores of all others in its category.

The official report states in its conclusions that the points were calculated using logarithmic normalisation (Suleymanov, Mullaev and Mahkamov, 2026, p. 54), while its methodological section gives the linear formula Bi = (Ki/Km) × Bt (Suleymanov, Mullaev and Mahkamov, 2026, pp. 15-16). The recalculation shows that the published points follow the linear formula exactly; for example, in the Applied category, 9.18/55.92 × 5 = 0.821 points, as published. The discrepancy does not change the published scores, but it is not merely editorial, because the two rules produce very different distributions of points. Table 5 compares the official rule with four alternatives applied to the same index values.

Table 5.

Distribution of points under alternative normalisation rules[15]

Normalisation rule	Applied: median, points	Applied: below 10% / at least 50% of max, %	Medical: median, points	Medical: below 10% / at least 50% of max, %	Social-Humanitarian: median, points	Social-Humanitarian: below 10% / at least 50% of max, %
Official: Ki/Km	0.072	92.9 / 3.6	0.206	88.9 / 11.1	0.154	69.4 / 8.1
Logarithmic: ln(1 + Ki)/ln(1 + Km)	0.730	21.4 / 7.1	0.872	22.2 / 11.1	0.624	14.5 / 22.6
Square root: (Ki/Km)^0.5	0.600	25.0 / 3.6	1.014	0.0 / 11.1	0.680	8.1 / 21.0
Ratio to the 90th percentile, capped	1.616	10.7 / 35.7	0.766	22.2 / 11.1	0.411	37.1 / 22.6
Percentile rank in the category	2.589	7.1 / 53.6	2.778	0.0 / 55.6	1.524	9.7 / 51.6

Under the logarithmic rule described in the report, the median score in the Applied category would be 0.730 points instead of 0.072, and the share of Applied institutions below 10% of the maximum would fall from 92.9% to 21.4%. For example, the Tashkent University of Information Technologies, ranked third in the Applied category with an index of 2.59, receives 0.232 points under the official rule and would receive 1.582 points under the logarithmic rule. The square-root rule has a similar effect: weaker than the logarithmic rule in the Applied category and stronger in the Medical and Social-Humanitarian categories. Because both rules are monotonic, they do not change the order of institutions within a category (the Spearman correlation with the official index is 1.000); they change only the distances between institutions and therefore the number of points that each institution adds to its overall score in the national ranking.

Each rule has its own advantages and limitations. The linear rule is transparent and keeps the proportions between index values, but, as shown above, it makes the scores of all institutions depend on the leader. The logarithmic and square-root rules reduce the influence of extreme values while keeping the order of institutions, but they also reduce the reward for real differences in performance and are less intuitive for institutions. The cap at the 90th percentile removes the dependence on a single leader, but several institutions receive the same maximum score (three in the Applied category and seven in the Social-Humanitarian category), while in a very

[14] Note: in the last column, the second-highest index is used as the scale and the leader is capped at the maximum score. The Creative/Sport category (3 institutions) is not shown. Source: author's calculations based on Suleymanov, Mullaev and Mahkamov (2026).

[15] Note: maximum score 5 points in the Applied (n = 28) and Medical (n = 9) categories and 3 points in the Social-Humanitarian category (n = 62). All rules are applied to the published index values. Source: author's calculations based on Suleymanov, Mullaev and Mahkamov (2026).

small category such as Medical the percentile is still pulled up by the leader. The percentile rank gives the most even distribution of points, with a median close to half of the maximum in every category, but it ignores the size of the differences between institutions: a small improvement and a large improvement can have the same effect. No rule is free of trade-offs, which is why the choice should be explicit, justified and tested before adoption (OECD and JRC, 2008; Greco et al., 2019).

The results have direct implications for how institutions plan their research activity. First, because points are relative to the category leader (Section 4.5), an institution that improves its index may receive no more points if the leader improves faster. For planning purposes, it is therefore more informative to monitor the index and its components than the points alone.

Second, the marginal value of a paper differs by type and by institution. For the median Social-Humanitarian institution, one additional Q4 paper adds about 0.0006 points, a Q1 paper about 0.0048 points, a Top 10% paper in a Q1 journal about 0.0108 points and a Top 1% paper in a Q1 journal about 0.018 points. In relative terms, one Top 1% paper in a Q1 journal is worth as much as 30 Q4 papers. The formula thus gives clear priority to high-quartile and highly cited work.

Third, for institutions with a high share of publications without a quartile (Section 4.1), the choice of journals with a Scopus quartile is a simple way to make existing research effort visible in the indicator. Fourth, the numerator includes all papers in the institution's Scopus profile, while the denominator counts only staff in their main position and internal part-time staff (Suleymanov, Mullaev and Mahkamov, 2026). Papers by external part-time staff or other affiliated authors are thus counted in the numerator without a corresponding entry in the denominator. This asymmetry is a feature of the definition rather than an observed behaviour, but it should be considered when the indicator is linked to funding.

The results show that the research output indicator behaves differently from what its design suggests. The weights are intended to reward quality: citation impact and high-quartile journals. In practice, the order of institutions is determined mainly by the volume of publications per staff member, while the weights and the overlap between components change ranks relatively little. This is consistent with the finding that nominal and effective weights can differ (Paruolo, Saisana and Saltelli, 2013). It also means that the indicator rewards publication volume more than its weights imply, which is the type of incentive observed under publication-count funding formulas (Butler, 2003; Hicks, 2012).

The staff denominator and the normalisation rule have larger effects. Because output is divided by staff numbers, the value of a paper differs by up to 89 times within a category, and small institutions can reach very high index values. Because points are scaled to the leader, one outlier can leave most institutions in a category with almost no points. When the indicator is linked to funding from 2027, these features will create very strong incentives for some institutions and very weak incentives for others.

The distribution of points may matter for funding, because from 1 January 2027 financial incentives are tied to ranking results (President of the Republic of Uzbekistan, 2026). Under the linear rule, about nine in ten Applied and Medical institutions receive less than 10% of the maximum score on this indicator. For these institutions, the indicator provides almost no differentiation: an institution with a median index and an institution near the bottom of the category receive very similar numbers of points. The indicator therefore separates the leader from the rest more than it separates the rest from each other. If funding on this indicator were proportional to points, the category leader alone would account for about 62% of the points in the Applied category and about 72% in the Medical category, and the remaining institutions would be separated by very small differences. A rule that spreads points more evenly, such as those in Table 5, would give institutions in the middle of the distribution a stronger signal that improvement is rewarded.

The experience of other countries also suggests that institutions will translate the national formula into internal rules (Aagaard, 2015). If an institution rewards individual academics in proportion to weight units, the ratios shown in Table 2 will be transferred directly to individual researchers. Such internal rules may encourage useful changes, such as publishing in better journals, but they may also encourage behaviour that the formula rewards without improving research, such as selecting journals only by quartile. Institutional managers should therefore use the components of the indicator for diagnosis rather than copying the formula mechanically into individual incentive schemes.

These findings do not mean that the composite indicator is wrongly designed. Weighting by quartile and citation impact signals that quality matters, the staff denominator allows comparison between institutions of different size, and the linear normalisation is transparent. The problem is that the combination of these elements produces effects that are not visible from the formula and are not reported with the results. The analysis is cross-sectional and uses one year of data; it does not show how stable institutional index values are over time, and it cannot identify the quartile of Top 1% and Top 10% papers, which would be needed to measure the full extent of double counting. In addition, papers are counted in institutional Scopus profiles, so a paper with several Uzbek affiliations is counted for each institution, and institutions without a Scopus profile are outside the analysis. The alternative normalisation rules are applied to the published index values and do not take into account how institutions might change their behaviour under a different rule.

CONCLUSIONS AND PROPOSALS

The study evaluated the research output indicator of Uzbekistan's national university ranking at the level of 105 institutions. Five conclusions follow. First, the overlapping weights give a single Top 1% paper in a Q1 journal 30 weight units, while 18.6% of publications without a quartile contribute nothing unless they are highly cited. Second, the weighting changes the order of institutions relatively little: even the simple number of

publications per staff member gives a rank correlation of 0.935 with official scores. Third, the staff denominator makes the value of a paper differ by up to 89 times within a category, and the highest index values are concentrated in small institutions. Fourth, the normalisation rule of the research output indicator makes the scores of most institutions depend on a single leader: in the Applied and Medical categories, about nine in ten institutions receive less than 10% of the maximum score. Fifth, the choice of normalisation rule matters as much as the choice of weights: the logarithmic rule mentioned in the official report would raise the median Applied score tenfold without changing the order of institutions within the category.

Based on these results, the following proposals are made:

1. Remove the overlap between the components of the composite indicator by counting each Scopus paper once, at its highest category, so that the weights express the intended priorities directly.
2. Introduce a minimum staff threshold or a multi-year average for small institutions, so that a few papers cannot move scores excessively.
3. Use a normalisation that is less dependent on the leader, for example a cap at a high percentile of the category, and test its effect on the overall ranking before adoption (OECD and JRC, 2008).
4. Publish the components of the indicator (publications per staff member, quartile structure and citation percentiles) together with the composite score, and describe the scoring method precisely and consistently.
5. Report the share of publications without a quartile for each institution, so that changes in coverage can be distinguished from changes in research performance.
6. Define the numerator and the denominator on the same basis, for example by stating how papers by external part-time staff are treated, before the indicator is used for funding decisions.

The proposals can be implemented in stages. In the first stage, the National Agency for Quality Assurance in Education could calculate the indicator in parallel under the current and the revised rules for the same year, as is done for the 2025 data in this article, and publish both results without changing the official scores. In the second stage, after consultation with institutions, the revised rules could be included in the regulation on the national ranking with a transition period announced before the data year to which they apply, so that institutions are not judged retroactively. Proposals 4 and 5 require only additional columns in the published report and can be applied immediately. Proposals 1 and 6 require article-level data and a precise definition of staff in the regulation, which can be obtained from Scopus and from the data that institutions already submit for the ranking. Proposals 2 and 3 change the distribution of points and should be tested for their effect on the overall ranking and on funding before adoption. At the institutional level, the same results can be used to set targets for the components of the index, such as the share of papers with a quartile and the share of high-quartile and highly cited papers, rather than for points alone.

Future research should use several years of data to test the stability of institutional index values and article-level data to measure the overlap between citation and quartile components directly.

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Author details / Muallif(lar) haqida / Сведения об авторе

Mamajonova Mukhlisakhon Muzaffar kizi Senior Lecturer, Department of Economics and Management, Tashkent State University of Economics, PhD in Economics / Mamajonova Muxlisaxon Muzaffar qizi Toshkent davlat iqtisodiyot universiteti "Iqtisodiyot va menejment" kafedrasi katta o'qituvchisi, iqtisodiyot fanlari bo'yicha falsafa doktori (PhD) / Мамажонова Мухлисахон Музаффар кизи старший преподаватель кафедры «Экономика и менеджмент» Ташкентского государственного экономического университета, доктор философии (PhD) по экономическим наукам
E-mail: mukhlisamamajonova0080@gmail.com

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