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A Policy-Weighted Resource-Allocation Framework for Open Research Competence Development: Balancing Open Access, Journal Infrastructure, and Training

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Abstract

This study develops and evaluates a normative policy-weighted, constrained resource-allocation framework, implemented through a composite indicator (C) and a linear allocation rule, to foster open research competence among Ukrainian university staff and align academic publishing with European standards. Using SCImago/Scopus data on open-access (OA) publications by Ukrainian institutions, the number of Ukrainian journals indexed in Scopus, and an author-constructed ordinal index of Open Science training intensity (Tr) for 2020–2025, linear programming was applied to guide resource allocation, and a retrospective reference case decomposition of observed C values was used to interpret changes in the indicator. OA share among Scopus-indexed Ukrainian-affiliated outputs rose from 50.25% (2020) to 63.64% (2025), while Scopus-indexed Ukrainian journals fell from 202 (2022) to 168 (2025). An integral open-research competence indicator increased from 0.088 (2020) to 0.816 (2024) before declining to 0.720 (2025). Under pre-specified policy weights and constraints, the allocation rule yields a corner-solution allocation of 45% to OA support, 35% to Open Science training, and 20% to journal infrastructure. The framework is a transparent decision-support tool for prioritising limited resources; it does not claim causal inference between capacity-building factors and Open Science outcomes.

Keywords: open science; open access; research competence; resource allocation; universities of Ukraine; linear programming; analytic hierarchy process

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1. Introduction

The integration of the Ukrainian research system into the European research ecosystem raises important questions about the compliance of domestic publishing practices with international standards. A key driver of this harmonisation is the open research competence of academic staff. Within the current landscape of scholarly communication, this competence should be understood as an integrated set of research, editorial, and management capabilities. It determines an individual author's ability to work according to the principles of Open Science and directly affects the sustainability and competitiveness of universities' institutional publishing infrastructure.

Open science has become one of the key norms of contemporary research policy, as it combines open access to publications, the reuse of research data, transparency of

methodologies, and wider societal participation in knowledge production (European Commission, n.d.; UNESCO, 2021). In the European Research Area, these practices have not only communicative but also regulatory significance: participation in Horizon Europe requires compliance with requirements for open access, FAIR data management, and responsible dissemination of research results (European IP Helpdesk, 2024). In Ukraine, these orientations are enshrined in the National Plan for Open Science, which provides a basis for universities' institutional transition to open research practices (Cabinet of Ministers of Ukraine, 2022).

For Ukraine, the issue of open science has become particularly important amid the full-scale military conflict. The destruction of scientific infrastructure, the loss of equipment, the forced mobility of researchers, and budgetary constraints have increased the need for digital tools to preserve and disseminate scientific results (UNESCO, 2024). The economic context is also critical, with real GDP declines starting in 2022 and limited public funding reducing universities' capacity to maintain research activity in traditional ways (National Bank of Ukraine, 2023; World Bank, 2026). Under such circumstances, open repositories, digital identifiers, open data, and international cooperation platforms transform from supplementary services into components of university institutional sustainability.

Previous studies show that the Ukrainian open-access system has a specific structure (Bediukh et al., 2024, 2025). On the one hand, the share of open publications is increasing, and international cooperation supports the visibility of Ukrainian science (Hladchenko, 2025; Kaliuzhna & Hauschke, 2024). On the other hand, the national journal landscape remains unevenly integrated into international databases, and conflict-related disruptions reinforce dependence on external publication and indexing channels (de Rassenfosse et al., 2023; Nazarovets, 2024). According to SCImago, Ukraine has significant scientific potential in the global publishing landscape. Yet this potential requires institutional support to transition from a quantitative presence to a sustainable open research infrastructure (SCImago, 2025).

At the same time, open access comes at a financial cost. The classic definition of Open Access emphasizes free access for the reader (Budapest Open Access Initiative, n.d.); however, in many models, the associated costs are transferred to authors or institutions through article processing charges (APCs). Together with FAIR data requirements and new open peer review models (Ross-Hellauer, 2017), this means that universities need to consider both publication budgets and the systematic development of open research competence. In this study, such competence is interpreted within the competence approach as an integrated set of knowledge, operational skills, and values that enable academic staff to conduct research in accordance with the principles of Open Science (Raven, 1984).

The financial dimension of the problem is exacerbated by the fact that the global transition to open access has not eliminated market concentration in academic publishing. Much of the revenue from open-access publishing accrues to a small number of large commercial publishers (Butler et al., 2023), which together generated over US$1 billion in APC revenue between 2015 and 2018 alone, with market concentration further increasing after the introduction of funder OA mandates such as Plan S (Butler et al., 2023; Grove, 2024). Analysis of hybrid open access for 2018–2022 revealed significant market concentration: three commercial publishers—Elsevier, Springer Nature, and Wiley—accounted for 49% of hybrid journals, representing 63% of the total article volume, and published 66% of the open-access articles in hybrid journals. Through transformative agreements, their market share reached 74% (Grove, 2024). Average article processing charges (APCs) in many disciplines have reached levels that represent a substantial financial burden for university budgets in middle-income countries (Budzinski et al., 2020; Butler et al., 2023; Klebel & Ross-Hellauer, 2023; Schimmer et al., 2015; Schönfelder, 2020; Solomon & Björk, 2016;

Vervoort et al., 2021). Therefore, the development of open research competence should include the ability to choose reliable and cost-effective publication channels, use Green and Diamond Open Access, work with institutional repositories, and avoid inefficient expenditure on publication fees.

It is also important to acknowledge that several major commercial publishers introduced APC waivers or discounts for Ukrainian-affiliated authors following the onset of the full-scale military conflict in 2022 [for example, Elsevier and Springer]. While these measures have reduced the immediate financial barrier for individual authors, they are time-limited and publisher-specific. They do not resolve the structural tension between subscription/APC-based publishing models and the transparency and reproducibility objectives of Open Science. The market-concentration concern raised in this article therefore relates to medium- and long-term systemic sustainability rather than to current emergency measures.

The research gap lies in the lack of a policy-weighted, constrained resource-allocation framework (a composite indicator combined with a linear allocation rule) that would enable quantitative assessment of the development of open research competence at Ukrainian universities while also supporting the distribution of limited resources among key areas of Open Science. Most available approaches view open science as a regulatory or infrastructure policy issue, but university governance requires a model that combines publishing openness, journal infrastructure, and researcher training.

In this study we treat the following as the primary desirable Open Science outcomes for the Ukrainian context under resource constraints: (1) the share of research outputs that are immediately openly accessible (OA share); (2) the maintenance and improvement of nationally controlled, internationally visible publication channels (proxied by the number of Scopus-indexed Ukrainian journals); and (3) the diffusion of practical Open Science competencies among academic staff (proxied by training intensity). We deliberately prioritise article-level openness over other important but currently unmeasurable dimensions (DOI coverage, ORCID uptake, FAIR data sharing, open peer review) because comparable national time-series data for the latter do not yet exist. The model is therefore a first-order approximation; future iterations should incorporate these additional outcome indicators as soon as systematic monitoring data become available.

The purpose of the article is to develop and evaluate a model for the development of open research competence among academic staff at Ukrainian universities in the context of harmonising academic publishing standards. The article has three objectives: first, to identify indicators suitable for a quantitative description of such competence; second, to calculate an integral indicator of its development for 2020–2025; and third, to propose a linear allocation rule for the distribution of limited resources among open publishing activity, journal infrastructure, and Open Science training programmes.

2. Materials and Methods

The methodological basis comprised general scientific and specialised research methods: system analysis, comparative analysis, statistical data-processing methods, policy-weighted resource-allocation modelling, indicator standardisation, integral evaluation, linear programming, and retrospective reference case decomposition. Unlike purely descriptive approaches, the proposed model operationalises open research competence as a measurable construct suitable for monitoring and management planning.

The research process involved four stages. In the first stage, the content of open research competence was defined as a combination of cognitive, operational, and value-motivational components. The cognitive component covers knowledge of Open Science principles, open-access models, DOIs, ORCIDs, repositories, and Horizon Europe require-

ments. The operational component relates to depositing publications, preparing Data Management Plans, managing FAIR data, and using digital infrastructures. The value-motivational component covers academic integrity, readiness for open review, and international cooperation.

At the second stage, a system of indicators was formed (Table 1). Three indicators are included in the model:

(1) the OA indicator reflects the actual level of openness of the publication activity of Ukrainian institutions;

(2) indicator J characterises the institutional presence of Ukrainian scientific periodicals in the international academic space. It is assumed that a higher number of Scopus-indexed Ukrainian journals reflects, indirectly, broader institutional adoption of internationally recognised editorial and Open Science standards required for indexing (e.g., DOI assignment, ORCID integration, ethical publishing statements, metadata quality). This assumption is not separately tested here: J does not distinguish between fully open-access, hybrid, and subscription-based journals among those indexed, and changes in J may also reflect factors unrelated to Open Science practices, such as revisions to Scopus indexing criteria or journal consolidation. J is used solely as a convenient, publicly available proxy for the institutional presence of Ukrainian journals in the international indexing system. We do not claim that an increase in J is caused by improved Open Science practices, nor that every Scopus-indexed journal necessarily embodies high Open Science standards. The indicator does not distinguish full OA, hybrid or subscription titles. Any interpretation of J as reflecting editorial Open Science competence remains an untested assumption of the model and should be treated with caution. Future work should disaggregate J by access model (full OA vs. hybrid vs. closed) to test this assumption directly;

(3) the indicator Tr is used as an author-constructed metric of training activity, reflecting the educational and competence-building component of the model. Tr is not interpreted as official training statistics for each year but is used as a consistent index of training intensity, since complete comparable national data for 2020–2025 are not available.

Table 1. Key components and indicators of the open research competence development model.

Model Component	Content of the Component	Indicator in the Model	Expected Result
Open publishing activity	Dissemination of research results in open access	OA	Growth in the share of OA publications
Institutional presence in international bases	Presentation of Ukrainian journals indexed in Scopus	J	Strengthening the international visibility of Ukrainian science
Open Science Training Activity	Training of academic staff in the principles and practices of open science	Tr	Developing knowledge, skills and a culture of openness
Integral result	Generalised assessment of the development of open research competence	C	Increasing the level of open research competence

Source: Created by the authors.

Construction and limitations of the Tr index. Tr is an ordinal index assigned by the author team on a 0–30-point scale, informed by the observed intensity of documented national Open Science training and dissemination activity in each year—specifically, the number and scale of workshops and dissemination events affiliated with the European

Association of Science Editors (EASE), the Committee on Publication Ethics (COPE) and the Directory of Open Access Journals (DOAJ) in which the project's expert panel participated or which it tracked. Tr is not derived from a disclosed formula linking raw counts to the index value, and it is not drawn from official, independently verifiable training statistics, which do not exist in comparable form for Ukraine over 2020–2025; it should therefore be treated as an illustrative, expert-judgement proxy rather than a reproducible measurement, and its subsequent normalisation and treatment as a continuous input to C (Equation (3)) is a simplifying assumption. Because Tr reaches its normalised maximum (Tr_{norm} = 1.000) from 2023 onward, it contributes a constant value to C for the final three years of the series; consequently, the decline in C observed in 2025 is driven mechanically by the fall in J_{norm} to 0.000, not by any genuine change in training capacity, and should not be read as evidence that training activity deteriorated. A robustness check reporting C recomputed with Tr held constant at its 2020 value, and with Tr omitted and weights renormalised across OA and J only, is provided in Section 4.

To make the mapping from the conceptual components introduced above (cognitive, operational, value-motivational) to the indicators in Table 1 explicit:

OA is treated as a behavioural output of competence—what researchers actually do once they hold the relevant knowledge and skills—rather than as a direct measure of competence itself;

Tr is treated as a proxy for the operational/skill-building process by which competence is developed;

and J is treated not as a component of individual competence at all, but as an institutional-level enabling condition, namely the publishing infrastructure within which individual open-research behaviour takes place.

We make this mapping explicit here so that the logical chain from the theoretical definition of open research competence to the operationalising indicators (Table 1) and, subsequently, to the composite indicator (Equations (1)–(3)) can be traced and critiqued by readers.

It should also be stressed that OA, J and Tr do not operate at the same level of analysis. OA and Tr are proxies for individual and collective researcher behaviour (publishing choices, training uptake); J is an institutional-level enabling indicator that reflects the publishing infrastructure within which that behaviour takes place, and is not itself a measure of individual or editorial competence. We nonetheless combine them in a single composite index because our conceptual model of open research competence is explicitly multi-level—individual, faculty, university and national—rather than purely individual. This modelling choice is a limitation as well as a feature: it means C should be read as an indicator of systemic open-research capacity rather than of the competence of any individual researcher or editorial board.

A policy-weighted, constrained resource-allocation framework, implemented through a composite indicator (C) and a linear allocation rule, was used in the study to move from a qualitative description of the model to its quantitative assessment. The following function represents the integral indicator of the development of open research competence:

$$C = f(OA, J, Tr), \quad (1)$$

where *OA*—the share of open access publications (SCImago, 2025); *J*—the number of Ukrainian journals indexed in Scopus (Elsevier, n.d.); and *Tr*—the Open Science training activity index. It should be emphasised that C is a weighted composite index constructed from the chosen indicators and weights; the subsequent allocation results are mathematical consequences of this construction. The model is a normative decision-support instrument,

not a causal-inference or predictive model. No claim is made that changes in J or Tr cause changes in OA (or vice versa).

In the third stage, all indicators were normalised. Since these indicators differ in their units of measurement and ranges of variation, linear min–max normalisation was applied to enable their mathematical synthesis within a single integral indicator:

$$X_{norm} = \frac{X_i - X_{min}}{X_{max} - X_{min}}, \quad (2)$$

where (X_i)—the actual value of the indicator in the respective year, while X_{min} and X_{max}—respectively, the minimum and maximum values of the indicator over the entire analysed period from 2020 to 2025. The normalised indicators take values within the interval [0; 1]. The min–max normalisation was applied using the empirically observed minimum and maximum of each indicator over 2020–2025, rather than theoretical bounds (e.g., a 0–100% range for OA), in order to capture relative year-on-year progress within the observed Ukrainian context. We acknowledge this is a modelling choice: using the theoretical maximum for OA would compress its normalised values and change its relative contribution to C. We report this as a limitation and recommend that future work test the sensitivity of C to alternative normalisation schemes (e.g., theoretical bounds, z-score standardisation).

All indicators were interpreted as stimulants: an increase in each of them potentially enhances open research competence. The integral indicator *C* was calculated as a weighted sum:

$$C = 0.40 \cdot OA_{\text{norm}} + 0.25 \cdot J_{\text{norm}} + 0.35 \cdot Tr_{\text{norm}} \quad (3)$$

The weights $w_1 = 0.40$ (OA), $w_2 = 0.25$ (J) and $w_3 = 0.35$ (Tr) are normative policy parameters specified a priori by the research team. They were not statistically estimated and were not derived from a pairwise-comparison survey of experts; the rationale for the ordering OA > Tr > J is given below. To express the ordering in a standard multi-criteria format and to check that the three weights are mutually coherent, we represent them by a Saaty-type pairwise-comparison matrix whose entries are ratios of the pre-specified weights ($a_{ij} = w_i / w_j$; Equation (4)). Such a matrix is consistent by construction. Hence $\lambda_{max} = 3$ and CR = 0 (Equations (5) and (6)) are algebraic identities and must not be read as empirical evidence of expert agreement, of the validity of the weights, or of an AHP derivation. AHP (Saaty, 1980) is retained solely as a notational and internal-coherence device; it plays no role in determining the numerical values, and the 1–9 judgement scale was not used (the largest ratio is 1.6).

To operationalise the model while addressing national data limitations, the Open Science training activity index (Tr) is conceptualised as a methodological baseline and proof-of-concept demonstration. The strategic relevance of this framework has intensified alongside Ukraine's accelerating integration into the European Open Science ecosystem, the evolution of open access (OA) policies, and the roll-out of the Ukrainian Research Information System (URIS). The empirical foundation and research impulse for this construct originated three years ago within the scientific initiative funded under Project No. 26GF013-02, "Theoretical Foundations for Harmonising the Editorial Practices of Ukrainian Scientific Publications with International Standards for Ukraine's Competitive Integration into the European Open Science Area" (contract No. 132.03/0192 dated 2 March 2026, National Research Fund of Ukraine).

OA was assigned the highest weight (0.40) because national and EU Open Science policy frameworks treat immediate public accessibility of research outputs as the primary and most directly observable indicator of open science maturity, while J and Tr are treated as enabling infrastructural and capacity-building conditions rather than end outcomes in themselves. This is a normative prioritisation choice among several plausible alternatives—for instance,

a policy framework emphasising data reproducibility might instead assign the highest weight to data-sharing compliance or FAIR-data indicators once such data become available. We make this prioritisation explicit here so that the weighting scheme can be scrutinised, contested, or adapted by other researchers and institutions with different policy priorities.

Accordingly, the Tr variable synthesises empirical insights and longitudinal observations from capacity-building workshops and training initiatives conducted across Ukraine over recent years by international scientific communication organisations—including the European Association of Science Editors (EASE), the Committee on Publication Ethics (COPE), and the Directory of Open Access Journals (DOAJ)—in close collaboration with the project's expert team. Because complete and comparable data on the number of participants, contact hours, or certified programmes across all Ukrainian universities are not available, Tr functions solely as a demonstrative component of the model. It illustrates the educational dimension of open research competence and should be replaced by more granular indicators once systematic national monitoring data become accessible.

A panel of 12 experts was convened within Project No. 26GF013-02 (National Research Fund of Ukraine) as a consultative body. Its members are managing or chief editors of peer-reviewed journals hosted at Taras Shevchenko National University of Kyiv and other Ukrainian higher education institutions who took part in the project's dissemination and some training events (international editorial workshops, Oxford, 2026; publishing panels at the Kyiv Book Arsenal, 2025–2026). The panel could be considered as a purposive sample of the professional community the project addresses; it is either representative of Ukrainian academics or independent of the project (panel members received no remuneration for this consultation, are not co-authors, and took no part in data processing, in the calculation of C or in the linear programme). No individual numerical judgements (pairwise comparisons, point allocations or ranges) were collected, and no questionnaire, Delphi round or voting procedure was used. Consequently no quantitative aggregation was performed and no inter-expert agreement statistic exists; none is reported.

The constructed pairwise comparison matrix for the three criteria is as follows:

$$A = \begin{pmatrix} 1.000 & 1.600 & 1.143 \\ 0.625 & 1.000 & 0.714 \\ 0.875 & 1.400 & 1.000 \end{pmatrix} \quad (4)$$

To determine the weighting coefficients, the matrix was normalised by dividing each column element by its column sum, and the row averages were then calculated. The consistency of the matrix was verified by calculating the maximum eigenvalue (λ_{max} = 3), the consistency index (CI), and the consistency ratio (CR):

$$CI = \frac{\lambda_{max} - n}{n - 1} = \frac{3 - 3}{3 - 1} = 0, \quad (5)$$

$$\mathrm{CR} = \frac{CI}{RI} = \frac{0}{0.58} = 0, \quad (6)$$

where n—the number of criteria; RI—random consistency index. For n = 3, the value of RI = 0.58.

Column normalisation of matrix A and averaging of rows reproduces the weights exactly, as it must. This check therefore confirms only the arithmetic of the representation.

The relatively high weight assigned to OA reflects its direct measurement of publication openness. The weight assigned to Tr reflects the role of training in developing practical skills for working with repositories, DOI and ORCID systems, Data Management Plans (DMPs), and FAIR data. The lower weight assigned to J reflects the more

indirect contribution of journal infrastructure to the visibility and quality of national scientific communication.

At the fourth stage, the linear allocation rule (policy-weighted constrained allocation framework) was applied. For the allocation component, a hypothetical budget of UAH 1,000,000 was used and allocated among three areas: x_1—support for OA publications, x_2—support for Ukrainian journals indexed in Scopus, and x_3—Open Science training activities. The objective function is a weighted sum of allocation shares; with $c_i = w_i$ it encodes the pre-specified ranking of priorities rather than estimated returns to resources.

Since the study is based on aggregated open data, published sources, and the authors' own calculations, and does not involve personal data, no specialised procedure for obtaining ethics committee approval or informed consent from individual participants was required.

The proposed author's model of the development of open research competence among academic staff at Ukrainian universities is based on a four-level implementation structure: individual, faculty, university, and national. Each level has its own function, but they all form a single system for competence formation and maintenance.

At the individual level, the model aims to develop the knowledge, skills, and motivation of academic staff. This level involves developing proficiency in the principles of Open Science and Open Access, FAIR practices, and the use of ORCID, DOI, repositories, open data, and digital tools for scholarly communication. The main tools at this level are training, self-education, and the practical application of open research practices.

At the faculty level, open practices are disseminated through methodological collaboration, mentoring, twinning, seminars, and the exchange of experience between departments. This level facilitates the transition from individual staff competence to a collective culture of openness within the faculty.

At the university level, the model provides for the institutional consolidation of open science through Open Access policies, the development of institutional repositories, KPI monitoring, support for publishing activity, and the development of Ukrainian scientific journals indexed in Scopus and Web of Science. At this level, openness becomes an element of the university's strategy rather than an individual researcher's initiative.

At the national level, the model envisages coordination of open science through the Ministry of Education and Science of Ukraine, participation in Open4UA projects, interaction with EOSC, support for university publishing houses, development of national Open Science policies, and integration of Ukrainian universities into the European Research Area.

Consequently, the development of open research competence is not limited to individual training, but requires simultaneous work at the individual, faculty, university, and national levels, as shown in Table 2.

Table 2. Matrix of competences of the model of development of open research competence.

Component Competences	Individual Level	Faculty Level	University Level	National Level
Knowledge	• Open Science, Open Access, FAIR • ORCID, DOI, repositories • academic integrity	• local practices of open science • methodical interaction • exchange of experience	• OA institutional policies • KPI and monitoring • repository support	• Ministry of Education and Science of Ukraine, EOSC, Open4UA • national coordination • European integration
Skills	• self-archiving of publications • work with ORCID/DOI • search for OA resources	• twinning and mentoring • organisation of seminars • team interaction	• monitoring of OA indicators • administration of platforms • journal support	• networking of universities • analytics and coordination • scaling practices

Table 2. *Cont.*

Component Competences	Individual Level	Faculty Level	University Level	National Level
Attitude/ values	• readiness for open exchange • responsibility and transparency • quality orientation	• culture of cooperation • mutual support • dissemination of successful practices	• institutional support for openness • encouraging innovation • sustainable development of competences	• strategic sustainability of the system • enhancing RIs & R&D • integration into the ERA
Key indicators of the model				
OA—share of OA publications	J—number of Ukrainian journals indexed in Scopus/WoS	Tr—index of training activity	C—integral indicator of competence development	

Source: Created by the authors.

A feature of the proposed framework is the integration of a policy-weighted, constrained resource-allocation approach. The framework is considered not only as a descriptive scheme of competence development but also as a constrained allocation problem in which a weighted allocation objective (Z, whose coefficients mirror the weights of C) is maximised under limited resource constraints. Such resources include funding, study time, universities' organisational capacity, access to digital infrastructure, and the ability to scale training programmes.

3. Results

The dynamics of open publishing activity indicate the significant spread of Open Access in the scientific space of Ukrainian institutions. These figures are computed from SCImago/Scopus data and therefore reflect the OA share among Scopus-indexed Ukrainian-affiliated outputs only; they should not be extrapolated to Ukrainian research output as a whole, since a substantial share of domestic publishing (including many national-language journals, conference proceedings and humanities outputs) is not Scopus-indexed. The share of OA publications among Scopus-indexed Ukrainian outputs rose from 50.25% in 2020 to a peak of 64.71% in 2024, then eased slightly to 63.64% in 2025, remaining well above its 2020 level. These dynamics indicate that, even under the conditions of the ongoing military conflict, Ukrainian universities and scientific institutions retain the ability to maintain open scholarly communication. At the same time, the number of Ukrainian journals indexed in Scopus, after growing to 202 in 2022, decreased to 168 in 2025, creating a risk of institutional narrowing of the national publication space (Table 3).

To illustrate how C responds to the indicator movements actually observed, we report three retrospective reference cases drawn from Table 3: the change in C between 2024 and 2025 (R1), between 2023 and 2025 (R2) and between 2023 and 2024 (R3), each decomposed by indicator. These are observed changes, not forward-looking scenarios: they involve no exogenous assumptions about future values of OA, J or Tr and are not a test of the model. Prospective scenario analysis would require independently specified trajectories and is left for future work.

Because the scale is capped at 30 and Tr reaches this cap in 2023, Tr is constant thereafter, and it therefore cannot register any change in training activity after 2023; this is a ceiling (saturation) effect of the index, not evidence that training stabilised. Tr was assigned retrospectively by the author team, with knowledge of the project's aims, which is a further source of potential bias (hindsight bias) that cannot be excluded.

Table 3. Dynamics of model indicators and the integral indicator of open research competence, 2020–2025.

Year	Share of OA, %	OA_{norm}	J	J_{norm}	Tr, Points (0–30)	Tr_{norm}	Weight OA	Weight J	Weight Tr	C	Absolute Growth C
2020	50.25	0.000	180	0.353	10	0.000	0.40	0.25	0.35	0.088	—
2021	56.63	0.441	194	0.765	15	0.250	0.40	0.25	0.35	0.455	0.367
2022	58.03	0.538	202	1.000	20	0.500	0.40	0.25	0.35	0.640	0.185
2023	60.88	0.735	186	0.529	30	1.000	0.40	0.25	0.35	0.776	0.136
2024	64.71	1.000	177	0.265	30	1.000	0.40	0.25	0.35	0.816	0.040
2025	63.64	0.926	168	0.000	30	1.000	0.40	0.25	0.35	0.720	−0.096

Note: The weighting coefficients are constant across all years of the analysed period (w_{OA} = 0.40, w_J = 0.25, w_{Tr} = 0.35); they were specified a priori and were not recalculated annually. Source: Calculated by the authors in Microsoft Excel based on Scopus data; the full set of raw and normalised values can be provided as Supplementary File (on request).

The calculation of the integral indicator C showed uneven but generally positive dynamics. As Figure 1 and Table 3 show, C rose from 0.088 in 2020 to a peak of 0.816 in 2024 before falling to 0.720 in 2025. This decrease is primarily due to a drop in indicator J, as the standardised number of Ukrainian journals indexed in Scopus reached its lowest level for the entire period. Consequently, under the structure of the present model, the value of C is sensitive not only to individual-level openness but also to the stability of the institutional publishing environment (indicator J).

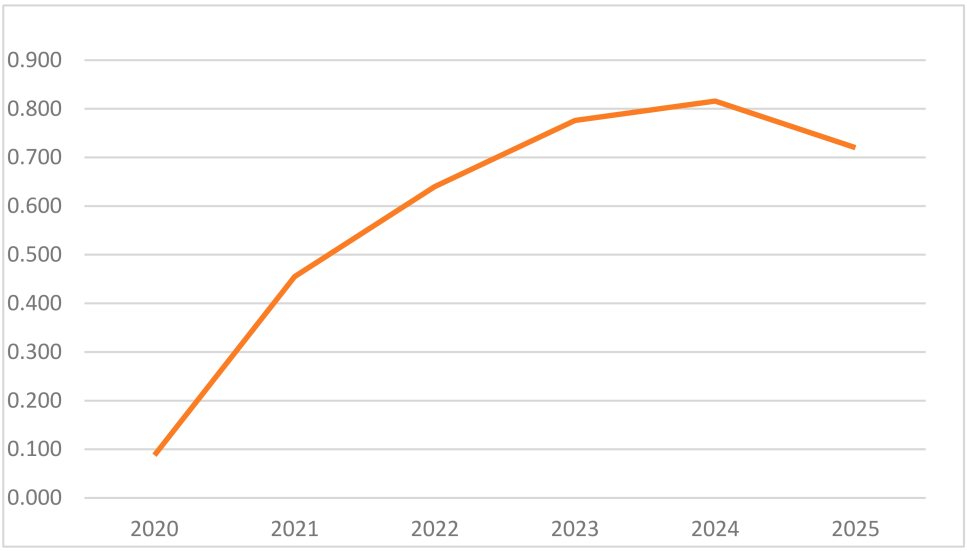

Figure 1. Dynamics of integral indicator C in 2020–2025. Source: Created by the authors based on calculations in Microsoft Excel.

Robustness of C to the treatment of Tr is examined next. Because Tr is author-constructed and constant from 2023, we recomputed C in two variants:

(i) Tr held at its 2020 value (Tr_{norm} = 0, so $C = 0.40 \cdot OA_{norm} + 0.25 \cdot J_{norm}$);
(ii) Tr omitted and the weights renormalised across OA and J (0.615 and 0.385). Results are in Table 4.

In all three specifications C peaks in 2024 and declines in 2025 (ΔC = −0.096, −0.096 and −0.147), so the 2025 decline is driven by J and does not depend on Tr. Because Tr is constant from 2023, variant (i) changes the level of C but not its changes after 2023. The rank ordering of the six years is largely preserved (Spearman ρ = 0.83 between the baseline

and each variant; n = 6, descriptive only). However, the cumulative rise in C between 2020 and 2025 falls from 0.632 (baseline) to 0.282 (variant i) and 0.434 (variant ii): about 55% of the baseline rise (0.35 of 0.632) is attributable to the author-constructed Tr. The "generally positive dynamics" of C in Section 3 should therefore be read as conditional on Tr.

Table 4. Integral indicator C under alternative treatments of Tr, 2020–2025.

Year	C, Baseline (Equation (3))	C, Tr Fixed at 2020 Value	C, Tr Omitted (Weights 0.615/0.385)
2020	0.088	0.088	0.136
2021	0.455	0.368	0.566
2022	0.640	0.465	0.716
2023	0.776	0.426	0.656
2024	0.816	0.466	0.717
2025	0.720	0.370	0.570

Source: Calculated by the authors from the data in Table 3.

To determine the optimal distribution of resources across the main areas of model implementation, a linear programming problem was used to obtain an illustrative allocation under pre-specified weights and bounds. The goal of the linear allocation rule is to maximise the overall effect of resource allocation:

$$maxZ = \sum c_i x_i, \quad (7)$$

where x_i is the share of resources directed to the corresponding area of model implementation, and c_i is the importance weight used as a stand-in for an efficiency coefficient of that area.

The coefficients correspond to the indicator weights for OA, J, and Tr, reflecting their relative significance in forming the integral indicator of open research competence. It should be noted explicitly that the coefficients c_i used in the objective function below are numerically identical to the normative importance weights w_i used in the composite indicator (Equation (3)). This is a simplifying modelling choice, not an independent empirical finding: a stated policy priority for a dimension (importance weight) is not the same quantity as the marginal benefit generated by an additional unit of resource invested in that dimension (an efficiency or return coefficient), and the two would generally differ if estimated separately, for example from an empirical production or response function relating funding to OA/J/Tr outcomes. Because no such empirical response function currently exists for the Ukrainian context, we reuse the importance weights as a transparent, if conservative, stand-in for efficiency coefficients; this conflation is a limitation of the present normative exercise and is flagged as a priority for future empirical work (Section 4). This allows the significance of the criteria to be combined with subsequent allocation calculations in the Microsoft Excel Solver environment (the full Solver configuration can be provided in Supplementary File S1 (on request)). The objective function has the form:

$$Z = 0.40x_1 + 0.25x_2 + 0.35x_3 \rightarrow max, \quad (8)$$

where x_1 is the share of resources aimed at supporting OA publications; x_2 is the share of resources aimed at supporting Ukrainian scientific journals indexed in Scopus; and x_3 is the share of resources directed to Open Science training.

The weights and the bounds in Equations (10)–(12) were fixed by the research team. The bounds follow three explicit rules. (1) Floors: each area receives at least the level the research team judged to be the minimum viable one (25% for OA support, 20% for journal infrastructure, 25% for training), so that no area is excluded. (2) Ceilings: each ceiling is set

below 50% (45%, 35% and 45% respectively) so that no single area can absorb a majority of the budget; the lower ceiling for J reflects its lowest importance weight. (3) All values are expressed in steps of five percentage points. The floors sum to 70%, so only 30% of the budget is freely allocated. These thresholds were therefore selected as a transparent managerial calibration for the proof-of-concept model, rather than estimated from historical university budget data or an independent empirical optimisation study. Their purpose is to define a feasible and balanced decision space, not to claim that these percentages represent universal budget norms. Future applications of the model should test the sensitivity of the optimal solution to alternative bounds based on institution-specific budget data or broader expert elicitation. Given these bounds and the linear objective function, the allocation implied by the pre-specified ranking and bounds corresponds to a corner solution in which each variable is pushed toward the bound favoured by its efficiency coefficient; this is an expected property of linear programming with box constraints and should not be read as evidence of a more complex underlying trade-off structure.

The model constraint is given as follows:

$$x_1 + x_2 + x_3 = 1, \tag{9}$$

$$0.25 \leq x_1 \leq 0.45, \tag{10}$$

$$0.20 \leq x_2 \leq 0.35, \tag{11}$$

$$0.25 \leq x_3 \leq 0.45. \tag{12}$$

The first constraint means that all available resources must be fully distributed among the three areas. The lower limits ensure that no direction is excluded from funding, as each one is necessary for the model to function. The upper limits prevent excessive concentration of resources in a single direction and ensure balance within the model.

The bounds in (10)–(12) reflect two managerial considerations rather than an independent empirical optimisation. No material disagreement about the ordering OA > Tr > J was expressed; comments concerned the wording of the indicators. Because no formal procedure was used, any consensus was informal. The panel did not propose numerical weights or bounds. The bounds are not derived from budget data, expert-supplied ranges or an empirical optimisation; because the LP solution is fully determined by them.

As with the AHP weights above, these thresholds are explicit normative choices made by the research team, not values derived from an independent statistical optimisation, and readers applying the model to other institutional contexts are invited to substitute their own thresholds.

Budget constraint, assuming a hypothetical annual funding amount of UAH 1,000,000:

$$F1 + F2 + F3 \leq 1000000, \tag{13}$$

where F1, F2, F3—amounts of funding for the relevant areas.

In addition to the financial limitations, the conditional time resource of the model implementation is considered:

$$T1 + T2 + T3 \leq 100, \tag{14}$$

where 100 h per year is the estimated time limit used for the proportional distribution of organisational resources among the model directions.

Because F1 = 1,000,000 $\times$ x_1 (and similarly for F2, F3), and Ti is, by convention, allocated in proportion to x_i, constraints (13) and (14) are mathematically implied by (9)–(12) and add no independent binding condition to the allocation problem; they are retained

solely to translate the abstract allocation shares xi into illustrative monetary and time quantities for the discussion below, not as additional decision-relevant constraints.

Because the objective function (8) is linear and the feasible region (9)–(12) is a bounded polytope, the maximiser is necessarily attained at a vertex (corner) of that polytope, a general property of linear programmes with box constraints; given the ranking c_1 (0.40) > c_3 (0.35) > c_2 (0.25), the largest share of resources should be allocated to supporting open access and OA publications—45%, or UAH 450,000 under a hypothetical budget of UAH 1,000,000—because OA has the highest importance weight (0.40), which is used here as a stand-in for an efficiency coefficient. The second priority area is Open Science training—35%, or UAH 350,000—which highlights the importance of the educational and competence-building component for achieving sustainable changes in research practices. Support for Ukrainian journals indexed in Scopus should receive 20%, or UAH 200,000. This does not diminish the importance of this area; however, within the model's framework, its impact on individual-level open research competence is more indirect than that of OA publications and training activities. The value of the objective function at this vertex is:

$$Z = 0.40 \cdot 0.45 + 0.25 \cdot 0.20 + 0.35 \cdot 0.35 = 0.3525. \quad (15)$$

This value is not an independently derived finding; it is a calculable consequence of the pre-specified weights and constraint bounds and serves only as an illustration of the model's structure. With $c_i = w_i$, the solution is determined by the rank order of the weights (OA > Tr > J) and by the bounds: the budget is allocated first to OA up to its ceiling, then to Tr, with J at its floor. No trade-off between the areas is estimated, and the result carries no policy-decision value beyond this illustration.

Table 5 shows that the allocation, and the value of Z, move with the bounds and with the rank order of the weights; the identical Z under the base case and under the swapped OA/Tr weights illustrates that Z is not an informative quantity in itself.

Table 5. Dependence of the LP solution on the bounds and weights (illustrative; recomputed by the authors).

Specification	Bounds x1/x2/x3, %	Weights (OA/J/Tr)	Allocation x1/x2/x3, %	Z
Base case (manuscript)	25–45/20–35/25–45	0.40/0.25/0.35	45/20/35	0.3525
Narrower bounds	30–40/25–30/30–40	0.40/0.25/0.35	40/25/35	0.3450
Wider bounds	15–55/10–40/15–55	0.40/0.25/0.35	55/10/35	0.3675
Higher floor for J	25–45/30–40/25–45	0.40/0.25/0.35	45/30/25	0.3425
OA and Tr weights swapped	25–45/20–35/25–45	0.35/0.25/0.40	35/20/45	0.3525
J given the highest weight	25–45/20–35/25–45	0.35/0.40/0.25	40/35/25	0.3425

A retrospective reference case decomposition was used to describe the observed changes in C and their sources (Table 6). This approach accounts for the fact that the actual dynamics of the integral indicator C depend on training activity and the stability of the institutional environment, particularly indicator J (Figure 2).

Table 6. Retrospective reference cases: observed changes in C and their decomposition by indicator.

Reference Case (Observed Period)	OA Contribution	J Contribution	Tr Contribution	ΔC
R1: 2024→2025	−0.030	−0.066	0.000	−0.096
R2: 2023→2025	+0.076	−0.132	0.000	−0.056
R3: 2023→2024	+0.106	−0.066	0.000	+0.040

Source: Calculated by the authors from Table 3. Contributions = weight × change in normalised value.

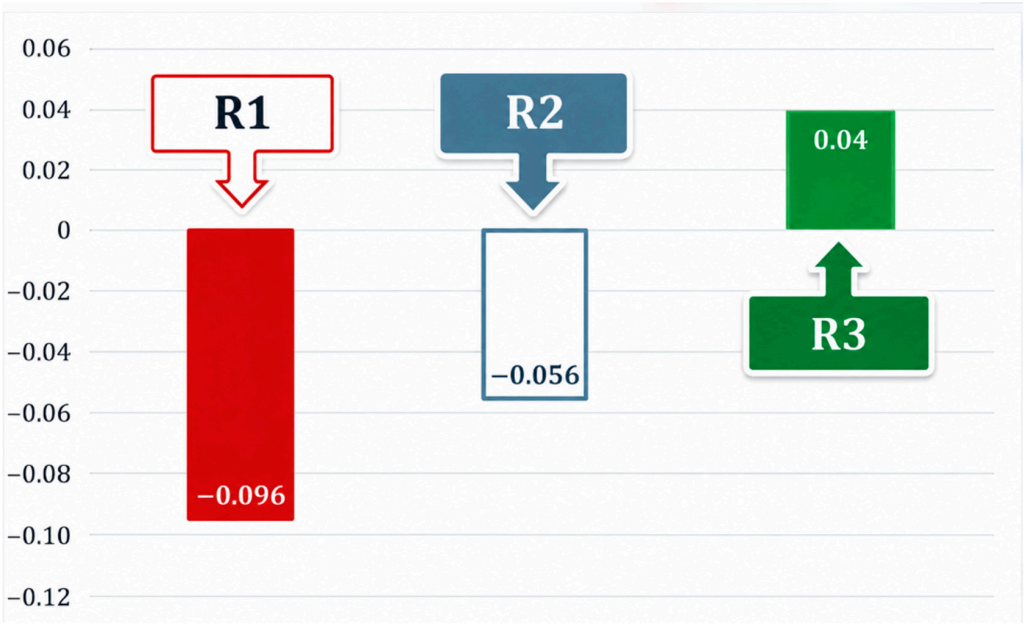

Figure 2. Retrospective reference cases of the increment of the integral indicator C. Source: Created by the authors in Microsoft Excel.

The decomposition shows that the contribution of J is negative in all three reference cases and dominates the decline in R1 and R2, consistent with the interpretation in Section 3 that the 2025 fall in C is driven by J. Case R3, in which C rose, reflects an increase in OA (+0.106) while J was still falling (−0.066); it therefore does not represent a recovery of the institutional component. Tr contributes nothing in any case because it is constant from 2023, so these cases cannot inform any conclusion about the effect of training. They do not constitute an independent empirical test of risk.

Thus, the policy-weighted, constrained resource-allocation framework enabled an operationalisation of open research competence as a composite indicator and an illustrative linear allocation rule.

4. Discussion

The central interpretive caution is that the model does not demonstrate causal relationships. The statement that open research competence cannot be reduced to individual digital literacy follows directly from the deliberate inclusion of J and Tr alongside OA; it is not an independent empirical result. Likewise, the observed co-movement of indicators is descriptive, not causal. Testing whether institutional capacity or training intensity actually improves Open Science outcomes would require a different research design, such as panel data, difference-in-differences, or matched institutional comparisons. Such designs lie outside the scope of the present normative allocation exercise.

Given the structure and weights of the model, the composite indicator C cannot be reduced to individual digital literacy alone; by construction, it also incorporates institutional publishing infrastructure (J) and training intensity (Tr). This is a design feature of the framework, not an empirical finding. The resulting construct represents multi-level institutional capacity that combines author behaviour, publishing infrastructure, editorial standards, university repositories, data management, and open-access financial mechanisms. This interpretation is consistent with international experience in university open publishing, research infrastructures, and capacity-building projects, including UCL Press, OpenAIRE, and Open4UA (Lviv Polytechnic National University, n.d.; OpenAIRE, n.d.; UCL Press, n.d.).

This multidimensionality follows directly from the model's construction—the integral indicator C combines OA, J, and Tr by design—and should therefore be read as a structural premise of the model rather than an empirically discovered causal finding. The model does not test a causal relationship between, for example, institutional capacity and improved Open Science outcomes. Instead, it evaluates and compares indicator trajectories under a pre-specified weighting scheme. Testing such causal links would require a separate research design (e.g., panel regression, difference-in-differences across institutions, or matched comparisons of universities with differing training intensity) that falls outside the scope of the present descriptive, policy-weighted allocation framework.

Overall, the model offers a structured quantitative lens that can complement normative approaches to open science by supporting resource allocation decisions under constraints. By combining indicator-based evaluation with linear programming and *retrospective reference case decomposition*, it provides academic editors, university managers, and policymakers with a transparent tool for prioritising scarce resources among open-access support, journal infrastructure, and researcher training. The quantitative relationship identified between training intensity (Tr), publishing infrastructure (J), and open-access outcomes (OA) should be treated as a working hypothesis that requires further testing with disaggregated editorial-competence data. In the context of the current situation in Ukraine, this prioritisation nevertheless provides a practical, data-informed roadmap for aligning national publishing ecosystems with European editorial and ethical standards.

The observed reduction in the number of Ukrainian journals indexed in Scopus, from 202 in 2022 to 168 in 2025, is unlikely to be explained by physical conflict-related disruption alone; we cannot rule out that it also reflects, in part, gaps in Open Science competencies within some national editorial boards; however, this interpretation is speculative, as the present study does not directly measure open research competence or investigate the specific reasons for individual journal delistings. Equally plausible, and not distinguished by the data used here, are alternative explanations such as routine Scopus re-evaluation cycles, changes in indexing criteria, or journal consolidation unrelated to Open Science practice; disentangling these explanations would require journal-level qualitative or archival research beyond the scope of this article. It is plausible that increased scrutiny by international indexing databases during 2022–2025 disproportionately affected journals that had not moved beyond a passive digital presence towards active Open Science integration. While the model does not directly measure editorial competencies and therefore cannot establish causality, this pattern is consistent with the interpretation that supporting journal infrastructure (J) is unlikely to succeed without parallel investment in the editorial competencies required by the modern European Research Area.

The dimensions chosen to operationalise open research competence (OA, J, Tr) were cross-checked, post hoc, against domain-specific Open Science competence frameworks: UNESCO's (2021) Open Science Recommendation, whose monitoring dimensions include open access to publications, open research infrastructure, and open science skills/training, closely paralleling OA, J and Tr respectively; the European Open Science Cloud (EOSC) (European Open Science Cloud (EOSC), n.d.) core competence framework; and FOSTER's open science training taxonomy (FOSTER Open Science, n.d.), both of which likewise separate output openness, infrastructure, and training/skills as distinct pillars. This supports the plausibility of treating OA, J and Tr as three distinct, jointly relevant dimensions, while none of these frameworks was designed or validated as a psychometric instrument for measuring individual competence, and neither is the present model. More broadly, the construction of C follows the general logic of composite-indicator practice described in the JRC/OECD Handbook on Constructing Composite Indicators (OECD/European Union/EC-JRC, 2008), including explicit normalisation and weighting choices; consistent

with the cautions raised by the Leiden Manifesto for research metrics (Hicks et al., 2015), we treat C as a transparent, policy-normative summary measure rather than a definitive ranking or causal explanatory variable, and we discourage its use as a sole basis for institutional evaluation or comparison.

A methodological limitation of the proposed framework lies in the operationalisation of open research competence and editorial quality. In this study, indexing in international databases such as Scopus is employed primarily as a quantifiable proxy indicator rather than an absolute, all-encompassing metric of scientific excellence or adherence to Open Science principles. While database indexing provides standardised, verifiable, and internationally recognised parameters for evaluating research visibility and output, it does not fully capture the nuanced qualitative dimensions of research integrity, community engagement, or institutional context.

In addition, although the cognitive component of the framework (Section 2) references a broader set of Open Science practices—DOI assignment, ORCID uptake, data-sharing compliance, and FAIR data management—the current model uses only the share of open-access publications (OA) as an outcome indicator. This choice reflects the absence of systematically collected, comparable national statistics on DOI/ORCID coverage or data-sharing rates for Ukrainian institutions over 2020–2025, rather than a judgement that OA is the sole relevant outcome. Future extensions should incorporate these as additional, separately weighted outcome indicators once comparable data become available and should test empirically whether they move together with or independently of OA share.

Consequently, the reliance on Scopus metrics should be interpreted as a practical modelling abstraction designed to capture broad systemic trends among Ukrainian researchers. Future iterations of the model could benefit from integrating multi-criteria frameworks that incorporate qualitative peer evaluations, local open-access repository analytics, and alternative metrics (altmetrics). This would complement formal indexing data and offer a more holistic assessment of open research competence aligned with evolving European standards.

A further limitation concerns the Tr indicator. As an author-constructed ordinal proxy based on the intensity of known training initiatives, it cannot claim the same empirical robustness as the OA and J indicators derived from bibliometric sources. Future applications of the model should therefore either replace Tr with officially collected training statistics or treat it strictly as an illustrative variable.

5. Limitations

Potential bias in the expert-informed elements. The expert panel consisted of editors drawn from the professional community that is both the target of the project's training activities and a potential beneficiary of policies prioritising open-access support, training and journal infrastructure. The panel's qualitative endorsement of the ordering OA > Tr > J and of the need for non-zero minimum allocations therefore cannot be treated as independent validation of the weighting scheme, and may reflect shared institutional interests and prior exposure to the project's framing. Our mitigations are partial: the weights and bounds were fixed and disclosed by the research team, AHP is not presented as expert-derived, and Table 5 shows how strongly the results depend on the bounds. Independent validation would require individually elicited judgements from stakeholders outside this community (for example university finance officers, research administrators, funders and researchers who are not editors), using a structured method such as a Delphi process or an AHP survey that reports consistency ratios per expert and for the group.

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Min–max normalisation over a six-point series magnifies small raw changes: the fall of J from 177 to 168 journals (−5.1%) between 2024 and 2025 becomes a change in J_{norm} from 0.265 to 0.000 only because 2025 is the series minimum. Moreover, because the minima and maxima are taken over 2020–2025, adding a further year would rescale all earlier values of C; C is therefore comparable only within the analysed window, and raw values of OA and J are reported alongside normalised values in Table 3 for this reason.

6. Conclusions

The model presented here is a normative, policy-oriented decision-support tool. Its quantitative results reflect the indicators and weights chosen by the authors; they should not be read as causal discoveries.

The proposed model for the development of open research competence combines a four-level implementation structure, three competence components, a system of quantitative indicators, and a policy-weighted, constrained resource-allocation mechanism (a composite indicator and a linear allocation rule). Its practical value lies in the fact that it makes it possible to describe the directions of competence development, quantitatively assess their dynamics, illustrate the allocation of resources under pre-specified weights and bounds, and determine the effectiveness of model implementation in the context of Ukraine since 2022.

The obtained results show that the Ukrainian case differs from the models of well-funded European systems. Ukraine combines a relatively high and growing share of open publications with limited financial capacity to pay APCs and a vulnerable national journal infrastructure. This creates a management dilemma: if universities rely only on the commercial Gold OA model, formal openness may increase, but inequalities between institutions and researchers will deepen. That is why Diamond OA, institutional repositories, inter-university publishing platforms, and centralised APC funds can be more sustainable mechanisms for the next period than an exclusive focus on author-paid publication models.

For scientific journal editors and publishing platform managers, the results mean that journal infrastructure should be considered part of Open Science capacity. Reducing the number of Ukrainian journals indexed in Scopus may reduce the variety of publication channels available to Ukrainian researchers and weaken the country's representation in global scientific communication. Therefore, strengthening the capacity of editorial offices, implementing transparent review policies, maintaining DOI and high-quality metadata, promoting publication ethics, improving the English-language visibility of journal websites, and complying with the requirements of international databases remain essential elements of institutional open research competence—irrespective of the specific causes of the observed decline in J (including routine Scopus re-evaluation cycles, changes in indexing criteria, or journal consolidation).

For universities, the R3 case shows that the greatest effect is achieved not through concentrating resources in one direction but through balanced support. OA publications ensure direct openness of results, training develops researchers' competencies, and journal infrastructure creates sustainable channels of national and international communication. Such a balance is especially important for resilience, as it allows for the simultaneous preservation of scientific results in a digital environment, maintenance of international visibility, and more rational use of limited budgets. The broader international context also confirms that, during periods of systemic disruption, the importance of open, networked, and sustainable research systems increases.

The practical value of the model lies in its potential as a university monitoring tool. A university can calculate the OA, J, Tr, and C indicators each year, compare them with the previous period, and adjust resource decisions accordingly. For example, if the share of OA

publications increases but the Tr indicator remains low, it is advisable to invest in short, advanced training modules. If J falls, the priority should be to support editorial offices and improve journal websites, DOI management, metadata, and ethical procedures. If APC barriers remain high, the university should develop a repository, Diamond OA, and collective author-support mechanisms.

Beyond internal resource reallocation, government- or consortium-level negotiation with commercial publishers—e.g., national Read-and-Publish agreements, consortia APC discounts, or extensions of existing waivers—represents a complementary policy lever not directly captured by the linear allocation rule. Because such agreements can lower the effective cost of Gold OA without requiring proportional increases in Tr or J, future versions of the model could treat negotiated APC discounts as an additional decision variable or as a retrospective reference case parameter affecting the OA-related budget requirement.

Further research should focus on validating the model at the level of individual universities or groups of universities, as well as on constructing a panel database on open science in Ukraine. A separate research direction should examine the costs of various open-access strategies: commercial Gold OA, Diamond OA, Green OA, institutional repositories, and transformational agreements. Such research would enable a transition from conditional allocation to evidence-based budget planning for Open Science programmes.

It should be noted that Diamond OA is not cost-free: it typically relies on volunteer editorial labour, university or library subsidies, or short-term project grants, and is often run on open-source platforms (e.g., OJS) with limited technical and marketing capacity. Its sustainability therefore depends on stable institutional funding rather than the elimination of publishing costs altogether. Moreover, its effect on the specific metrics used in this study is not automatic: a Diamond journal that is not indexed in major bibliometric databases would not improve J, and volunteer-run editorial teams may struggle to meet the DOI, metadata, and long-term preservation standards required for Scopus inclusion. Diamond OA should therefore be treated as a complementary rather than universal strategy, whose net effect on the model's indicators warrants separate empirical assessment.

Therefore, the development of open research competence is a necessary condition for modernising and restoring the Ukrainian system of higher education and science. The proposed model demonstrates that open research competence should be developed through a combination of open publishing activity, journal infrastructure support, and systematic training of scientific and teaching staff. In the recovery period, such a combination can strengthen the international visibility of Ukrainian research, reduce the risk of losing scientific output, ensure compliance with European Open Science requirements, and increase the efficient use of limited financial resources.

In sum, open research competence should be treated as a measurable, multidimensional framework that links researchers' publication and peer-review skills with institutional open science policies, sustainable funding approaches for open access, and the resilience of national publishing infrastructure. When embedded in university governance and policy, this framework can support the consistent alignment of academic publishing in Ukraine with European editorial standards.

Supplementary Materials: The following supporting information can be downloaded at https://www.mdpi.com/article/10.3390/publications14040069/s1. The following supporting information is provided with this article: File S1 (Supplementary_File_S1_Open_Research_Competence_Framework.xlsx), an Excel workbook containing the raw and normalised indicator values for 2020–2025, the AHP pairwise-comparison matrix with the weight and consistency calculations, the Microsoft Excel Solver configuration of the linear allocation problem, and the recomputations underlying Tables 4–6 can be provided upon the request.

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Data Availability Statement: The data used to calculate the OA indicator, defined as the share of open-access publications, were obtained from SCImago Journal & Country Rank (SCImago, 2025; https://www.scimagojr.com/countrysearch.php?country=UA; accessed on 3 August 2026). The data supporting the J indicator, defined as the number of Ukrainian journals indexed in Scopus, were obtained from the Scopus source title list (Elsevier, n.d.; https://downloads.ctfassets.net/o78em1y1w4i4/7xtaTxNiNcWRTeZkV86eNy/710bfd3c7f7c7c9c88eeb3638ba4be43/ext_list_Jun_2026.xlsx; accessed on 3 August 2026; access may require an institutional subscription). The extraction filter applied was: country of publisher/affiliation = Ukraine, active status as of 31 December of each reference year, distinct serial titles. The Tr indicator was constructed by the authors as an Open Science training activity index. The indicator values and all derived calculations are presented in Table 3 and Figures 1 and 2 of the article. In addition, a supplementary data file (Supplementary File S1, Excel workbook) can be provided upon the request. It contains all raw and normalised indicator values for 2020–2025, the AHP pairwise-comparison matrix with the weight and consistency calculations, the Microsoft Excel Solver configuration of the linear allocation problem (decision variables, objective function, constraints and solution), and the recomputations underlying Tables 4–6. No other dataset was generated.

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References

Bediukh, O., Dunaievska, O., Hurtman, Y., Zhenchenko, M., Izarova, I., Naumova, M., & Kharlamova, G. (2024). *Ecosystem of Ukrainian scientific publications: Harmonisation of practices with international standards. Part 1: Challenges for authors in the scholarly publishing system* [In Ukrainian]. VPTs "Kyivskyi universytet". [CrossRef]

Bediukh, O., Hurtman, Y., Danylchenko-Cherniak, O., Dunaievska, O., Zhenchenko, M., Izarova, I., Naumova, M., Rohozha, M., Stavytskyy, A., & Kharlamova, G. (2025). *Ecosystem of Ukrainian scientific publications: Harmonisation of practices with international standards. Part 2: Organisational, legal and economic challenges for publications in the scholarly publishing ecosystem* [In Ukrainian]. VPTs "Kyivskyi universytet". [CrossRef]

Budapest Open Access Initiative. (n.d.). *Read the declaration*. Available online: https://www.budapestopenaccessinitiative.org/read/ (accessed on 3 August 2026).

Budzinski, O., Grebel, T., Wolling, J., & Zhang, X. (2020). Drivers of article processing charges in open access. *Scientometrics*, *124*, 2185–2206. [CrossRef]

Butler, L.-A., Matthias, L., Simard, M.-A., Mongeon, P., & Haustein, S. (2023). The oligopoly's shift to open access: How the big five academic publishers profit from article processing charges. *Quantitative Science Studies*, *4*(4), 778–799. [CrossRef]

Cabinet of Ministers of Ukraine. (2022). *On approval of the national plan for open science: Order of 8 October 2022 No. 892-r* [In Ukrainian]. Available online: https://zakon.rada.gov.ua/laws/show/892-2022-%D1%80#Text (accessed on 9 September 2026).

de Rassenfosse, G., Murovana, T., & Uhlbach, W.-H. (2023). The effects of war on Ukrainian research. *Humanities and Social Sciences Communications*, *10*, 856. [CrossRef]

Elsevier. (n.d.). *Scopus content: The source title list*. Available online: https://downloads.ctfassets.net/o78em1y1w4i4/7xtaTxNiNcWRTeZkV86eNy/710bfd3c7f7c7c9c88eeb3638ba4be43/ext_list_Jun_2026.xlsx (accessed on 3 August 2026).

European Commission. (n.d.). *Open science*. Available online: https://research-and-innovation.ec.europa.eu/strategy/strategy-research-and-innovation/our-digital-future/open-science_en (accessed on 3 August 2026).

European IP Helpdesk. (2024). *Your guide to open science in Horizon Europe*. Publications Office of the European Union. Available online: https://bibliotecnica.upc.edu/sites/default/files/pagines_generals/investigadors/european_ip_helpdesk-ea0924355enn.pdf (accessed on 3 August 2026).

European Open Science Cloud (EOSC). (n.d.). *EOSC core competence framework*. Available online: https://eosc.eu/ (accessed on 3 August 2026).

FOSTER Open Science. (n.d.). *FOSTER Open Science training taxonomy*. Available online: https://share.google/BrKlJ763OAQozIe2R (accessed on 9 September 2026).

Grove, J. (2024). *For-profit publishing giants 'big winners' of open access push*. Times Higher Education. Available online: https://www.timeshighereducation.com/news/profit-publishing-giants-big-winners-open-access-push (accessed on 15 May 2026).

Hicks, D., Wouters, P., Waltman, L., de Rijcke, S., & Rafols, I. (2015). Bibliometrics: The Leiden Manifesto for research metrics. *Nature*, *520*(7548), 429–431. [CrossRef] [PubMed]

Hladchenko, M. (2025). Access models, authorship patterns, and citation impact in Ukrainian scholarly publishing (2020–2023). *Scientometrics*, *130*, 6349–6374. [CrossRef]

Kaliuzhna, N., & Hauschke, C. (2024). Open access in Ukraine: Characteristics and evolution from 2012 to 2021. *Quantitative Science Studies*, *5*(4), 1022–1041. [CrossRef]

Klebel, T., & Ross-Hellauer, T. (2023). The APC-barrier and its effect on stratification in open access publishing. *Quantitative Science Studies*, *4*(1), 22–43. [CrossRef]

Lviv Polytechnic National University. (n.d.). *OPEN4UA: Open science for Ukrainian higher education system*. Available online: https://lpnu.ua/en/open4ua (accessed on 3 August 2026).

National Bank of Ukraine. (2023). *Comment by the National Bank on the change in real GDP in 2022* [In Ukrainian]. Available online: https://bank.gov.ua/ua/news/all/komentar-natsionalnogo-banku-schodo-zmini-realnogo-vvp-u-2022-rotsi (accessed on 3 August 2026).

Nazarovets, M. (2024). Unlocking the hidden realms: Analysing the Ukrainian journal landscape with Ulrichsweb. *Learned Publishing*, *37*(3), e1605. [CrossRef]

OECD/European Union/EC-JRC. (2008). *Handbook on constructing composite indicators: Methodology and user guide*. OECD Publishing. [CrossRef]

OpenAIRE. (n.d.). *Open scholarly communication infrastructure*. Available online: https://www.openaire.eu/ (accessed on 3 August 2026).

Raven, J. (1984). *Competence in modern society: Its identification, development and release*. H. K. Lewis.

Ross-Hellauer, T. (2017). What is open peer review? A systematic review. *F1000Research*, *6*, 588. [CrossRef] [PubMed]

Saaty, T. L. (1980). *The analytic hierarchy process: Planning, priority setting, resource allocation*. McGraw-Hill.

Schimmer, R., Geschuhn, K. K., & Vogler, A. (2015). *Disrupting the subscription journals' business model for the necessary large-scale transformation to open access*. Max Planck Digital Library. [CrossRef]

Schönfelder, N. (2020). Article processing charges: Mirroring the citation impact or legacy of the subscription-based model? *Quantitative Science Studies*, *1*(1), 6–27. [CrossRef]

SCImago. (2025). *SCImago journal & country rank, 1996–2025*. Available online: https://www.scimagojr.com/countrysearch.php?country=UA (accessed on 3 August 2026).

Solomon, D. J., & Björk, B.-C. (2016). Article processing charges for open access publication: The situation for research intensive universities in the USA and Canada. *PeerJ*, *4*, e2264. [CrossRef] [PubMed]

UCL Press. (n.d.). *Leading the way in open access publishing*. Available online: https://www.uclpress.co.uk/ (accessed on 3 August 2026).

UNESCO. (2021). *Recommendation on open science*. UNESCO. [CrossRef]

UNESCO. (2024). *Analysis of war damage to the Ukrainian science sector and its consequences*. UNESCO. Available online: https://unesdoc.unesco.org/ark:/48223/pf0000388803 (accessed on 3 August 2026).

Vervoort, D., Ma, X., & Bookholane, H. (2021). Equitable open access publishing: Changing the financial power dynamics in academia. *Global Health: Science and Practice*, *9*(4), 733–736. [CrossRef] [PubMed]

World Bank. (2026). *Updated Ukraine recovery and reconstruction needs assessment released*. Available online: https://www.worldbank.org/en/news/press-release/2026/02/23/updated-ukraine-recovery-and-reconstruction-needs-assessment-released (accessed on 3 August 2026).

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