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GREEN PUBLIC PROCUREMENT AND SME ACCESS UNDER FISCAL DECENTRALISATION: MEASURING REGIONAL VALUE RETENTION IN ZAKARPATTIA REGION

Abstract. *The article examines green public procurement in Zakarpattia Region under fiscal decentralisation, with particular emphasis on access for small and medium-sized enterprises (SMEs) and on distinguishing contract value, regional value retention, and tax receipts credited to local budgets. The study combines an analysis of regional budgetary and tax indicators for 2020–2025 with Prozorro data, regulatory and legal acts, and regional strategic documents. A multi-level approach is applied to procurement case analysis: level A1 identifies procedures containing a machine-readable environmental-criteria marker in the Prozorro system; level A2 involves documentary verification of specific and measurable environmental requirements; level B covers supplier characteristics and the identification of the supplier's functional model; and level C provides scenario-based assessment of regional and fiscal effects. Three procedures selected according to predefined criteria are examined in depth and treated as research cases rather than as an exhaustive set of green procurement procedures in the region. Two complementary author-developed indicators are proposed: the Regional Value Retention Ratio (RVR), which measures the share of contract value retained within the region through*



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payroll, local purchases, subcontracting, and operating surplus, and the Subnational Fiscal-Effect Ratio (SFER), which reflects tax receipts credited to community and oblast budgets in accordance with applicable statutory allocation rules. Using a hypothetical UAH 10 million contract, SFER sensitivity is analysed under minimum, baseline, and maximum scenarios. The results show that the subnational fiscal effect depends on the labour intensity of the contract, the supplier's tax regime, and the taxable margin. The scientific novelty of the study lies in integrating RVR and SFER with a functional supplier typology and a four-level A1–A2–B–C evidence framework, thereby enabling a clear distinction between procurement value, regional value retention, subnational fiscal effects, and the level of empirical verification. The practical significance of the study lies in developing approaches to monitoring green public procurement and improving SME access through lotting, life-cycle costing, and post-award monitoring.

Keywords: green public procurement, small and medium-sized enterprises (SMEs), fiscal decentralisation, regional value retention ratio (RVR), subnational fiscal-effect ratio (SFER), local budgets, tax revenues, Prozorro.

JEL Classification: H57, H71, H72, Q56.

Анотація. У статті досліджено зелені публічні закупівлі в Закарпатській області в умовах бюджетної децентралізації з основним акцентом на доступі малих і середніх підприємств (МСП) та розмежуванні вартості договору, регіонального утримання вартості й податкових надходжень до місцевих бюджетів. Дослідження поєднує аналіз бюджетних і податкових показників регіону за 2020-2025 роки, даних Prozorro, нормативно-правових актів та регіональних стратегічних документів. Для аналізу закупівельних кейсів застосовано багаторівневий підхід: на рівні A1 ідентифіковано процедури з машинно зчитуваною позначкою екологічних критеріїв у системі Prozorro; рівень A2 передбачає документальне підтвердження конкретних і вимірюваних екологічних вимог; рівень B - характеристику постачальника та визначення його функціональної моделі; рівень C - сценарне оцінювання регіональних і фіскальних ефектів. Для поглибленого аналізу використано три процедури, відібрані за визначеними критеріями та розглянуті як дослідницькі кейси, а не як повна сукупність зелених закупівель області. Запропоновано два взаємодоповнювальні авторські індикатори: коефіцієнт утримання регіональної вартості (Regional Value Retention Ratio - RVR), що характеризує частку вартості контракту, яка утримується в регіоні через оплату праці, місцеві закупівлі, субпідряд та операційний результат, і коефіцієнт субнаціонального фіскального ефекту (Subnational Fiscal-Effect Ratio - SFER), який відображає податкові надходження, що відповідно до чинних правил розподілу зараховуються до бюджетів громад та обласного бюджету. На прикладі умовного контракту на 10 млн грн проведено аналіз чутливості SFER за мінімальним, базовим і максимальним сценаріями. Встановлено, що субнаціональний фіскальний ефект залежить від трудомісткості контракту, податкового режиму постачальника та рівня оподаткованої маржі. Наукова новизна полягає в інтеграції RVR і SFER із функціональною типологією постачальників та чотирирівневою системою доказовості A1-A2-B-C, що дає змогу розмежувати вартість закупівлі, регіональне утримання вартості, субнаціональний фіскальний ефект і рівень їх емпіричної верифікації. Практичне значення результатів полягає у формуванні підходів до моніторингу зелених закупівель та розширення доступу МСП через лотування, оцінювання вартості життєвого циклу та післяконтрактний контроль.

Ключові слова: зелені публічні закупівлі, малі та середні підприємства (МСП), бюджетна децентралізація, коефіцієнт утримання регіональної вартості (RVR), коефіцієнт субнаціонального фіскального ефекту (SFER), місцеві бюджети, податкові надходження, Prozorro.



Absztrakt. A tanulmány a zöld közbeszerzéseket vizsgálja Kárpátalján a költségvetési decentralizáció körülményei között, különös tekintettel a kis- és középvállalkozások (KKV-k) közbeszerzési részvételére, valamint a szerződéses érték, a regionális értékmegtartás és a helyi költségvetésekben jóváírt adóbevételek elkülönítésére. A kutatás a 2020–2025 közötti regionális költségvetési és adómutatók elemzését a Prozorro adataival, a vonatkozó jogszabályokkal és regionális stratégiai dokumentumokkal kapcsolja össze. A közbeszerzési esetek elemzésére többszintű megközelítést alkalmaz: az A1 szint a Prozorro rendszerében géppel olvasható környezetvédelmi kritériumjelöléssel rendelkező eljárásokat azonosítja; az A2 szint a konkrét és mérhető környezetvédelmi követelmények dokumentumalapú ellenőrzését foglalja magában; a B szint a beszállító jellemzőinek és funkcionális modelljének meghatározására irányul; míg a C szint a regionális és fiskális hatások forgatókönyv-alapú értékelését tartalmazza. A meghatározott kritériumok alapján kiválasztott három eljárás részletes elemzés tárgyát képezi, és kutatási eseként, nem pedig a régió zöld közbeszerzéseinek teljes körű sokaságaként kerül értelmezésre. A tanulmány két egymást kiegészítő, a szerzők által kidolgozott mutatót javasol: a Regionális Értékmegtartási Rátát (Regional Value Retention Ratio – RVR), amely a szerződéses érték azon hányadát méri, amely munkabérek, helyi beszerzések, alvállalkozói teljesítések és működési eredmény formájában a régióban marad, valamint a Szubnacionális Fiskális Hatásrátát (Subnational Fiscal-Effect Ratio – SFER), amely a hatályos jogszabályi megosztási szabályok alapján a települési és megyei költségvetésekben jóváírt adóbevételeket tükrözi. Egy hipotetikus, 10 millió UAH értékű szerződés példáján a SFER érzékenységet alacsony, alap- és magas forgatókönyv mellett vizsgálja. Az eredmények azt mutatják, hogy a szubnacionális fiskális hatás a szerződés munkaintenzitásától, a beszállító adózási rendszerétől és az adóköteles árres mértékétől függ. A kutatás tudományos újdonsága az RVR és a SFER integrálásában rejlik a beszállítók funkcionális tipológiájával és a négy szintű A1–A2–B–C értékelési kerettel, amely lehetővé teszi a közbeszerzési érték, a regionális értékmegtartás, a szubnacionális fiskális hatások és az empirikus ellenőrzés szintjének egyértelmű elkülönítését. A kutatás gyakorlati jelentősége a zöld közbeszerzések monitoringját és a KKV-k hozzáféréseinek javítását szolgáló megközelítések kidolgozásában áll, különösen a részekre bontás, az életciklus-költség-számítás és a szerződés teljesítését követő monitoring alkalmazása révén.

Kulcsszavak: zöld közbeszerzések, kis- és középvállalkozások (KKV-k), költségvetési decentralizáció, regionális értékmegtartási arány (RVR), szubnacionális fiskális hatásmutató (SFER), helyi költségvetések, adóbevételek, Prozorro.

Problem description. Public procurement can shape markets through stable demand and requirements concerning energy efficiency, emissions, recycled content, repairability, chemical safety, waste reduction, and environmental management [1-4]. This function is particularly relevant during wartime and reconstruction, when regional economies must combine fiscal restraint, infrastructure renewal, SME resilience, and alignment with European environmental standards.

In Zakarpattia Region, green procurement may create demand for food, wood products, furniture, construction materials, energy services, waste management, and other activities identified in the regional strategy [5]. Fiscal decentralisation forms the institutional context for this potential: in 2020 the region formed 64 territorial communities and 6 enlarged districts, and from 2021 communities entered into direct interbudgetary relations with the state budget [6-9]. This reform placed greater procurement and fiscal responsibility on communities. At the same time, procurement capacity is fragmented among communities with unequal tax bases, staffing resources, and market access.

The analytical problem is to separate the procurement effect, the supplier and SME-access effect, the regional-retention effect, and the subnational fiscal effect. A contract awarded in the region does not automatically generate an equivalent regional return: the supplier may be registered elsewhere, resell imported goods, use non-regional inputs, or generate taxes credited outside the contracting community. Support for SME access must also comply with the principles of equal treatment, non-discrimination, transparency, and proportionality [10-11]. The practical task is therefore to design environmentally credible procedures that remain accessible to capable SMEs without territorial preferences and to distinguish budget revenues from the narrower category of tax receipts generated through statutory tax-allocation channels.

Literature review. International research considers green public procurement an instrument of environmental policy, innovation, resource efficiency, and organisational change. S. D. Sönnichsen and J. Clement [1] identify environmental labelling, life-cycle assessment and costing, professional competence, and organisational coordination as key implementation tools. C. Yu, T. Morotomi, and H. Yu [12], as well as J. Rosell [13], show that the application of green criteria depends on contract characteristics, sector, procedure, regulatory conditions, and the capacity of contracting authorities. H. S. Kristensen, M. A. Mosgaard, and A. Remmen [14] emphasise that formal environmental commitments require clear responsibilities, professional expertise, and internal coordination to become routine procurement practice.

O. Manta et al. [2], in line with the principles of the 2030 Agenda for Sustainable Development [15], associate sustainable procurement with the achievement of the Sustainable Development Goals and environmentally responsible market behaviour. V. S. Orfanidou, N. P. Rachaniotis, G. T. Tsoulfas, and G. P. Chondrokoukis [16] demonstrate that life-cycle costing requires reliable market information, comparable cost data, and transparent calculation methods, as the lowest purchase price does not always ensure the lowest total public cost.

Research on supplier access indicates that SMEs face relatively high administrative, financial, certification, and knowledge-related barriers. F. Schotanus, C. J. Gelderman, and R. Jupijn [17] identify limited procurement capacity and fragmented demand as important constraints. N. A. Masron, S. Ismail, and Z. Zainol [18] emphasise financial, legal, organisational, and personnel-related difficulties. At the same time, A. Deschamps [19] finds no evidence that green procurement systematically discourages SME participation, provided that environmental requirements are proportionate and equivalent forms of evidence are accepted. OECD evidence likewise shows that contract size, administrative complexity, disproportionate qualification requirements, and payment conditions can restrict SME access, while lotting, proportionality, simplified procedures, and e-procurement can reduce these barriers [37].



Ukrainian researchers focus on the legal, fiscal, and European-integration dimensions of green procurement. L. Rybina and N. Maslak [20] consider it an instrument for promoting the efficient use of public finances. V. Malolitnieva [21] examines its potential benefits and implementation challenges, while V. Malolitnieva and R. Dzhabrailov [22] analyse sustainable procurement in the context of the EU–Ukraine Association Agreement. A. Ovcharenko and T. Shulha [23] emphasise the integration of environmental requirements into the budget process.

EU4Environment materials [3; 24] identify market opportunities in resource-efficient production, eco-design, environmental management, eco-labelling, sustainable construction, and waste reduction. However, the regional transmission from green public contracts to SME access, supplier activity, regional value retention, and subnational tax receipts remains insufficiently examined, particularly under fiscal decentralisation.

Identification of previously unresolved parts of the general problem. The regional transmission from a green contract to SME participation, supplier activity, regional value retention, and tax receipts credited to subnational budgets remains insufficiently specified. Procurement data disclose the buyer, supplier, value, and procedure, but usually not contract-level payroll, taxable profit, local inputs, production location, subcontracting, SME status, or the territorial allocation of taxes. Since May 2023, Prozorro has provided structured fields for environmental requirements; nevertheless, the marker is self-reported, its use is incomplete, and it does not verify environmental quality or performance [25; 26]. A responsible assessment must therefore combine observable procurement data with document-level verification, supplier-level evidence, and clearly labelled scenarios, while avoiding the treatment of contract value or modelled tax receipts as realised regional effects.

Goals of the article. The study aims to develop an analytical framework for assessing SME access, regional value retention, and subnational fiscal effects of green public procurement under fiscal decentralisation in Zakarpattia Region. The study focuses primarily on SME access to green public procurement, while the proposed RVR and SFER indicators are applicable to suppliers irrespective of enterprise size. The objectives are to describe the territorial and fiscal context of community budgets; analyse general-fund own-source revenue and selected tax receipts; identify procurement barriers and instruments relevant to SMEs; classify supplier models; develop and operationalise the RVR and SFER indicators; compare sensitivity scenarios for alternative fiscal channels; and propose an evidence and monitoring framework that supports SME access without territorial discrimination.

The study is conceptual and analytical in nature and does not estimate the total number or value of verified green public procurement procedures in Zakarpattia Region. Its empirical base comprises Prozorro data [27], Ministry of Finance reports on general-fund own-source revenue for 2020–2025 [28], selected local-budget tax receipts [28; 29], procurement, budget, and tax legislation [10; 11; 30–33], the regional development strategy [5], official procurement records [34–36], and analytical

materials on environmental requirements in Prozorro [25; 26]. General-fund own-source revenue is treated as a budget-revenue indicator, whereas PIT, single tax, property tax, and corporate income tax are treated separately as tax receipts. This distinction is maintained throughout the analysis.

Methods and methodology. Dynamic analysis is used to assess changes in general-fund own-source revenue of local budgets in Zakarpattia Region for 2020-2025 and selected tax receipts for 2021-2025. Typological analysis classifies suppliers according to their functional role and potential contribution to regional value retention. Coefficient analysis is used to construct the RVR and SFER indicators and to link contract-level payroll, purchases, subcontracting, taxable profit, and statutory tax crediting. Logical modelling traces the transmission from contract award to production or supply, income formation, tax liability, and tax crediting. Scenario analysis tests the sensitivity of SFER to alternative payroll shares and taxable margins. The fiscal series characterises the financial environment of decentralisation rather than the dynamics or causal effects of green procurement. The main limitations are the institutional incomparability of the 2020 and post-reform budget systems, the reassignment of military-related PIT in 2024, inflation, incomplete use of structured environmental fields, the non-exhaustive nature of the verified regional case set, and the absence of contract-level payroll, profit, local-input, subcontracting, and tax-allocation data. VAT, SSC, tax credits, losses, exemptions, imported inputs, and indirect multiplier effects are excluded from the SFER scenarios unless explicitly stated otherwise.

To complement the fiscal analysis, a two-stage search and verification procedure was applied to procurement records from Zakarpattia Region. At the first stage (A1), procurement procedures announced by contracting authorities located in Zakarpattia Region between May 2023, when the structured environmental fields became available, and December 2025 were searched using the publication period, contracting-authority location, and the presence of the structured “Environmental criteria” marker on the official Prozorro record. Procurement IDs were subsequently recorded for the procedures retained for verification. Inclusion required: (i) a contracting authority located in Zakarpattia Region; (ii) publication within the observation period; (iii) a structured environmental marker that could be independently confirmed; and (iv) a publicly accessible procurement record. Keyword-only matches without a structured marker, records outside the region, duplicate records, and records for which the marker could not be independently verified were excluded.

Three procedures for which compliance with all inclusion criteria could be independently verified were retained for detailed analysis as a verified marker-based exploratory case set [34-36]. They represent goods, raw materials, and construction works. The set is not treated as an exhaustive census of green public procurement in the region, because use of the structured marker is incomplete and the publicly accessible search environment does not provide a complete regional series for the entire period. At the second stage, A2 classification requires document-level confirmation that environmental requirements are specific, measurable, relevant to the



procurement object, and linked to an identifiable verification method. Level B is applied only where supplier information can be verified and records organisational form, SME status where publicly ascertainable, location, production or distribution role, and the functional supplier model defined in Table 1. Where a characteristic cannot be verified, it is recorded as not verified rather than inferred. Level C contains modelled fiscal effects based on transparent assumptions.

The scientific novelty lies in the development and integration of four analytical elements: the author-developed Regional Value Retention Ratio (RVR), the author-developed Subnational Fiscal-Effect Ratio (SFER), a functional supplier typology, and a four-level A1-A2-B-C evidence framework. Unlike studies that focus primarily on the adoption of green criteria, SME participation, or life-cycle costing as separate issues [1; 12-19; 37], the proposed framework explicitly separates contract value from first-order regional value retention, tax receipts statutorily credited to community and oblast budgets, and the level of empirical verification. RVR is conceptually informed by local expenditure-retention approaches, including the LM3 logic of tracing how expenditure circulates within a local economy [38], but differs from LM3 because it measures first-order contract retention rather than successive rounds of re-spending. SFER is constructed specifically from Ukrainian statutory tax-allocation rules [30–32] and is not presented as an adaptation of an existing fiscal multiplier.

Main research results. During 2020-2025, the period used for the fiscal analysis, Law No. 922-VIII and, under martial law, Resolution No. 1178 of the Cabinet of Ministers governed procurement and permitted environmental characteristics, non-price criteria, and life-cycle costing where statutory requirements were met [10; 11]. This period does not denote a complete regional series of green procurement procedures. Law No. 4888-IX entered into force on 24 June 2026, while most provisions will become operational on 24 March 2027; it is therefore treated as a prospective transition rather than part of the empirical regime [33].

A procedure should be treated as environmentally substantive only when technical specifications, award criteria, contract conditions, or performance indicators contain measurable and verifiable requirements. Generic wording such as “environmentally friendly” is insufficient. Relevant characteristics may include energy efficiency, recycled content, restricted hazardous substances, repairability, legally sourced timber, organic production, emissions, water use, and take-back obligations [1; 3; 21].

The fiscal-transmission model contains five stages: contract award, production or supply, income formation, tax liability, and statutory crediting to subnational budgets. Contract value, procurement object, supplier, and financing source are directly observable; production location, regional inputs, payroll, taxable profit, and tax allocation usually are not. Consequently, procurement monitoring may identify a supplier and, where data permit, its SME status, but the regional economic and subnational fiscal effects require additional enterprise data or transparent modelling.

The regional effect depends more on the supplier's functional role and operating footprint than on its registration address. Zakarpattia Region has supply potential in agriculture and food production, wood processing, furniture, construction materials, energy efficiency, and environmental services [5]. Table 1 distinguishes the principal supplier models and their expected transmission channels; the typology applies to suppliers of any size, while its procurement-design implications are considered primarily from the perspective of SME access.

Local producers and labour-intensive service providers offer the greatest potential for retaining payroll and purchases in the region. A local distributor may retain only its trade margin, logistics expenditure, and sales payroll, while an external supplier creates a regional effect mainly through verified local operations or subcontracting. Cooperative supply can broaden SME access but requires coordination, traceability, and quality control. In all cases, the actual effect depends on the location of production, employment, inputs, subcontracting, and statutory tax crediting rather than on supplier registration alone.

Table 1

Supplier Models and Regional Fiscal Transmission

Supplier model	Typical categories	Regional retention	Main fiscal channel	Assessment
Local producer	Food, furniture, materials, packaging	Payroll, local inputs, assets	PIT; single or corporate income tax; property tax	High if production is in the region
Local labour-intensive service provider	Repair, catering, cleaning, energy, waste and water services	Payroll and local service inputs	PIT; single or corporate income tax	High where wages account for a large share of contract value
Local distributor	Equipment, lighting, machinery	Trade margin, logistics, sales payroll	PIT; single tax or corporate income tax, as applicable	Contract value may overstate regional retention
External supplier	Works, installation, centralised supply	Local subcontracting, if used	Taxes of local employees and subcontractors	Low without local operations
Cooperative or consortium	Food, wood products, crafts, specialised services	Distributed turnover and payroll	PIT, single tax, property-related payments	Potentially high; coordination risks require management

Source: developed by the authors based on [3; 5; 17-19; 30-32].

Note: The typology describes expected transmission channels. The actual regional effect requires verification of production location, payroll, subcontracting, local purchases, and tax allocation.

Machine-observable procurement data form a separate evidence layer. Since May 2023, structured fields in Prozorro have enabled the automated identification of lots



containing declared environmental requirements and the extraction of data by year, contracting authority, CPV code, procedure status, expected value, contract value, number of bids, and supplier registration [26]. BI Prozorro data indicate that 833 lots were marked in 2023 and from January to June 2024, but only seven procedures contained substantive environmental requirements entered directly in the relevant structured fields [25]. The marker therefore indicates the declared presence of environmental requirements rather than verified environmental performance. Structured data can be used to form a regional descriptive sample, whereas verification of the content of environmental criteria and their fulfilment requires document-level assessment.

To operationalise this distinction at the regional level, Table 2 presents the three verified marker-based exploratory cases retained through the search procedure described in the methodology. Evidence level A1 confirms machine-readable procurement data and the structured environmental marker. Classification at level A2 requires documentary confirmation that environmental requirements are specific, measurable, relevant to the procurement object, supported by an appropriate verification method, and, where applicable, subject to performance control. Level B concerns supplier characteristics and the functional supplier model defined in Table 1. The table therefore separates marker verification, document-level environmental evidence, and supplier-level evidence rather than treating the environmental marker as proof of verified green performance.

Table 2
Verified Marker-Based Procurement Cases in Zakarpattia Region, 2023–
2025: A1–A2–B Assessment

Year / ID	Contracting authority	Object / CPV	Value / result	Evidence assessment (A1–A2–B)
2023 UA-2023-05-31-008558-a	Executive Committee of Mukachevo City Council	Accumulator batteries for Military Unit A7084; CPV 31440000-2	Expected value: UAH 517,506.87, excluding VAT. Contract value: UAH 349,000; difference: UAH 168,506.87.	A1: confirmed structured environmental marker. A2: not assigned; the available public record does not by itself establish specific and measurable requirements concerning durability, hazardous substances, recycling, or end-of-life management. B: partially verified; the contract was awarded to an individual entrepreneur registered outside Zakarpattia Region. The supplier is therefore classified as an external distributor-type supplier. SME status, production location, and regional operating footprint were not independently verifiable.

Year / ID	Contracting authority	Object / CPV	Value / result	Evidence assessment (A1–A2–B)
2024 UA-2024-11-11-001939-a	Department of Education, Culture, Youth and Sports of Kostryna Village Council	Fuelwood; CPV 03410000-7	Expected value: UAH 350,000, including VAT. The procedure was unsuccessful and did not result in a contract.	A1: confirmed structured environmental marker. A2: not assigned; legal origin of timber, traceability, sustainable forest management, moisture, transport, and performance requirements require document-level verification. B: not applicable because the procedure did not result in a contract; therefore, no supplier model can be assigned and no realised RVR or SFER can arise.
2025 UA-2025-02-26-010203-a	Municipal Non-Profit Enterprise “Nyzhno-Apshanska Hospital” of Solotvyno Settlement Council	Reconstruction of the hospital building in Solotvyno; CPV 45450000-6	Expected value: UAH 31,997,649, excluding VAT. The procedure did not result in a contract.	A1: confirmed structured environmental marker. A2: not assigned; measurable requirements concerning energy efficiency, materials, construction waste, emissions, and post-award verification require document-level assessment. B: not applicable because the procedure did not result in a contract.

Source: compiled by the authors from official Prozorro procurement records [34-36].

Table 2 covers three substantively different procurement categories: accumulator batteries, fuelwood, and hospital reconstruction [34-36]. The cases were retained because the structured environmental marker could be independently confirmed, not because the procurement objects merely appeared environmentally relevant. They differ substantially in value, status, and the amount of evidence available at subsequent verification levels. The 2023 battery procurement resulted in a contract below the expected value [34]. At level B, the supplier can be classified only as a distributor-type supplier on the basis of the procurement object and available supplier information; the procurement record does not provide sufficient evidence to infer SME status, regional production, or local operating footprint. The 2024 fuelwood procedure was unsuccessful and did not result in a contract [35]. Accordingly, the case remains relevant for A1-level procurement-design analysis, while level B and realised RVR/SFER are not applicable. The 2025 hospital-reconstruction procedure likewise did not result in a contract and therefore cannot generate realised RVR or SFER [36].

The cases demonstrate why the evidence levels should not be collapsed. A1 identifies a declared environmental component but does not establish substantive environmental performance; A2 requires documentary verification; B describes verifiable supplier characteristics; and C represents modelled fiscal effects. Their

number and expected value cannot be interpreted as the total volume of verified green public procurement in Zakarpattia Region. Likewise, the difference between expected and contract value represents a procurement saving rather than a regional or fiscal effect. A comprehensive regional census would require a complete machine-readable export of all lots carrying the environmental marker, followed by document-level and supplier-level verification.

The nominal fiscal environment of budget decentralisation changed considerably in 2020–2025. General-fund own-source revenue excluding interbudgetary transfers is used to reflect the overall revenue capacity available to local budgets, with due consideration given to inflation, wartime mobility, tax-policy changes, and PIT allocation [28]. This budget-revenue indicator is distinct from the selected tax receipts analysed in Table 3. The fiscal series characterises communities' financial capacity for procurement rather than the dynamics of green procurement itself. The dynamics of general-fund own-source revenue of local budgets in Zakarpattia Region during 2020–2025 are presented in Figure 1.

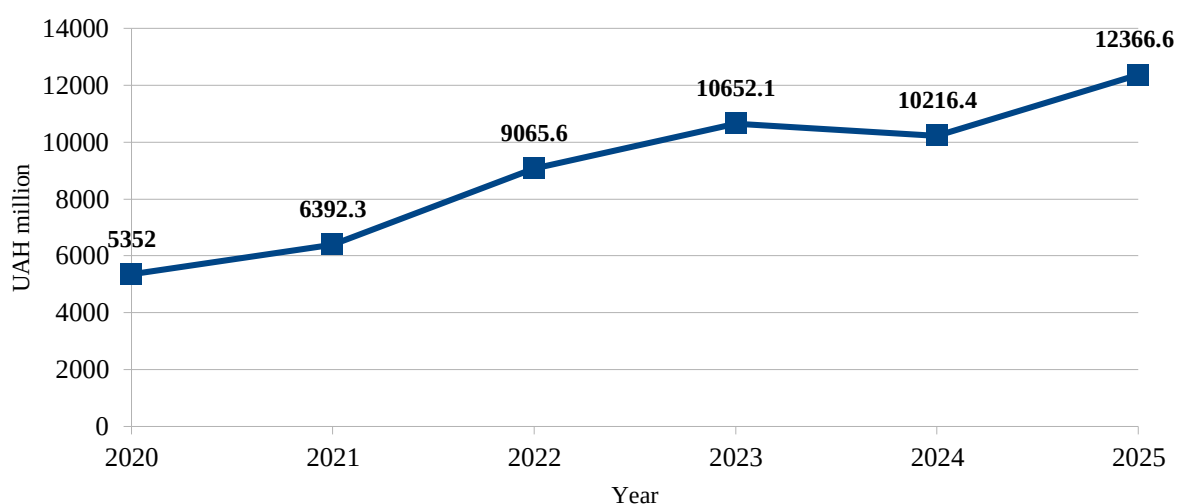


Figure 1. General-Fund Own-Source Revenue of Local Budgets in Zakarpattia Region, 2020–2025

Source: compiled from annual Ministry of Finance reports [28].

Note: Own-source revenue excludes interbudgetary transfers. The 2024 growth rate calculated on a comparable basis and published by the Ministry of Finance was +27.5%, whereas the actual amount declined because military-related PIT was redirected to the State Budget of Ukraine.

General-fund own-source revenue increased from UAH 5,352.0 million in 2020 to UAH 12,366.6 million in 2025. The nominal increase was UAH 7,014.6 million, or 131.1%, and the CAGR was approximately 18.2%. Revenue grew by 19.4% in 2021, 41.8% in 2022, and 17.5% in 2023. In 2024 the actual amount declined by 4.1% after military-related PIT was redirected to the State Budget, although the Ministry of Finance reported 27.5% growth in comparable conditions. In 2025 revenue increased

by 21.0%. These movements reflect several simultaneous fiscal and macroeconomic processes and cannot be attributed to green procurement. The figures are drawn from official annual tables and rounded to one decimal place. PIT includes receipts associated with public-sector, military, and other employment, while property tax includes liabilities of both enterprises and individuals. Therefore, these tax receipts cannot be attributed exclusively to enterprise activity or public procurement and should be analysed separately.

Table 3
Selected Local-Budget Tax Receipts in Zakarpattia Region, 2021–2025,
UAH million

Year	PIT	Single tax	Property tax	Corporate income tax
2021	4,173.5	805.2	596.6	87.8
2022	6,795.0	858.3	586.8	78.5
2023	7,567.6	992.7	758.4	95.6
2024	6,014.3	1,391.0	995.7	347.6
2025	7,191.9	1,525.4	1,249.3	641.4
Absolute increase, 2025/2021, UAH million	3,018.4	720.2	652.7	553.6
Growth, 2025/2021, %	72.3	89.4	109.4	630.5

Source: compiled from [28-29].

Table 3 presents selected local-budget tax receipts rather than an enterprise-specific tax measure. Between 2021 and 2025, PIT increased by 72.3%, the single tax by 89.4%, property tax by 109.4%, and corporate income tax by 630.5%. The increase in corporate income tax reflects a low initial base and may also be associated with changes in tax allocation, one-off payments, and an expansion of the regional corporate tax base. Wartime business relocation is a plausible contributing factor: official regional data report 283 relocated enterprises in Zakarpattia Region by mid-2024 and material tax payments by relocated businesses [39]. However, the aggregate fiscal data used in this study do not identify corporate income tax paid by relocated firms separately; therefore, the relocation effect cannot be isolated quantitatively and should not be interpreted as a causal estimate. Because PIT includes public-sector, military, and other employment, and property tax includes liabilities of individuals, the four tax series should be interpreted separately rather than aggregated as taxes generated by enterprises or procurement.

The annual dynamics were uneven, particularly after the reassignment of military-related PIT in 2024. Divergent trends in individual tax receipts altered the nominal revenue structure. Because communities differ in their tax bases and



administrative capacity, smaller communities may require grants, intermunicipal cooperation, or aggregated procurement to implement complex green projects.

A contract financed by one community may generate tax revenues in another jurisdiction, depending on where the supplier is registered, operates, employs staff, or owns taxable assets. Regional monitoring should therefore follow the spatial chain of production, employment, subcontracting, and tax crediting rather than assume that the contracting authority receives the full fiscal return.

To distinguish the regional economic effect from the subnational fiscal effect of a public contract, two complementary author-developed indicators are proposed. The Regional Value Retention Ratio (RVR) measures first-order retention of contract value through regional payroll, purchases, subcontracting, and operating surplus. Its conceptual logic is related to local expenditure-retention approaches such as LM3 [38], but RVR does not estimate subsequent rounds of local re-spending:

$$RVR = (W_r + P_r + S_r + G_r) / C \times 100\% \quad (1)$$

The components of RVR must be mutually exclusive to avoid double counting. The Subnational Fiscal-Effect Ratio (SFER) is a separate author-developed indicator that measures tax receipts actually credited, under the applicable legal rules, to community and oblast budgets:

$$SFER = (PIT^c + PIT^o + ST^c + CIT^o + PT^c) / C \times 100\% \quad (2)$$

Here, C is the contract value excluding VAT when VAT is separately identifiable. W_r is gross payroll attributable to the contract for employees whose workplace is in Zakarpattia Region; it should be derived from payroll records, timesheets, or contract/project cost centres, and shared personnel should be allocated proportionally to documented working time or labour cost. P_r comprises payments for goods and materials supplied through regional operating establishments and should be verified through invoices, supplier master data, and primary accounting records; supplier registration alone is insufficient. S_r comprises payments to subcontractors for work or services actually performed in the region and should be supported by subcontracts and acceptance documents. G_r is the contract-level operating surplus attributable to the regional operating unit or supplier and should be derived from management accounting or the contract margin after excluding amounts already recorded in W_r , P_r , and S_r . Where these data are unavailable, RVR should be reported as a Level C scenario rather than as a realised value. PIT^c and PIT^o denote the portions of personal income tax credited to community and oblast budgets, respectively; ST^c is the single tax credited to community budgets; CIT^o is the portion of corporate income tax credited to the oblast budget; and PT^c is property tax credited to the relevant community budget. Military levy, VAT, SSC, and state-budget shares of taxes are excluded from SFER because they do not constitute subnational-budget tax receipts.

The 2026 allocation rules applied in the scenarios credit 64% of ordinary PIT to community budgets, 15% to oblast budgets, and 21% to the State Budget of Ukraine. For corporate income tax paid by private-sector enterprises, 10% is credited to oblast budgets and 90% to the State Budget; corporate income tax is also one of the tax bases

used in the horizontal equalisation of oblast budget tax capacity [30; 32]. Accordingly, SFER includes only the 10% oblast share of corporate income tax. The Group 3 scenario assumes a 5% single-tax rate without VAT and statutory eligibility for the simplified regime. The PIT employment component may coexist with either supplier tax regime, whereas the single-tax and corporate-income-tax regimes are treated as mutually exclusive alternatives.

Table 4 evaluates SFER for a hypothetical UAH 10 million contract under three sensitivity scenarios. The payroll shares of 10%, 20%, and 30% and taxable margins of 3%, 5%, and 10% are illustrative minimum, baseline, and maximum assumptions rather than observed averages for Zakarpattia Region, Ukraine, or a specific economic activity. Their purpose is to test the sensitivity of the model and to avoid presenting a single assumed structure as an empirical norm.

Table 4

SFER Sensitivity Scenarios for a UAH 10 Million Green Public Contract

Case	Payroll / taxable margin	Employment SFER	Group 3 SFER	CIT-supplier SFER
Min.	10% / 3%	UAH 142,200 (1.42%)	UAH 642,200 (6.42%)	UAH 147,600 (1.48%)
Base	20% / 5%	UAH 284,400 (2.84%)	UAH 784,400 (7.84%)	UAH 293,400 (2.93%)
Max.	30% / 10%	UAH 426,600 (4.27%)	UAH 926,600 (9.27%)	UAH 444,600 (4.45%)

Source: authors' scenario calculations based on the statutory tax-allocation rules [30–32].

Note: C = UAH 10 million. The employment component equals PIT on the assumed payroll multiplied by the 79% combined community-and-oblast allocation. Group 3 SFER adds the 5% single tax to the employment component; the corporate-income-tax SFER adds the 10% oblast share of corporate income tax calculated on the assumed taxable margin. VAT, SSC, military levy, tax credits, losses, exemptions, property tax, and indirect effects are excluded. The Group 3 scenario assumes statutory eligibility and no VAT.

The sensitivity analysis shows that SFER is determined not by contract value alone but by the supplier's employment intensity, tax regime, taxable margin, and statutory tax allocation. Under the minimum, baseline, and maximum assumptions, the employment component ranges from UAH 142,200 (1.42% of contract value) to UAH 426,600 (4.27%). For an eligible Group 3 single-tax supplier, SFER ranges from UAH 642,200 (6.42%) to UAH 926,600 (9.27%), because the single tax is credited to the community budget in addition to the employment component. For a corporate-income-tax supplier, SFER ranges from UAH 147,600 (1.48%) to UAH 444,600 (4.45%); only the 10% oblast share of corporate income tax is included. These values are sensitivity results rather than forecasts or sectoral averages and should be replaced by contract-level data where such data are available.

A separate budget-expenditure perspective is useful for contextualising environmentally oriented public spending. In 2025, total expenditures of local budgets in Zakarpattia Region amounted to UAH 21,556.1 million, including UAH 17,962.6 million from the general fund and UAH 3,593.5 million from the special fund [40].



For monitoring purposes, a narrow environmental-protection expenditure proxy can be constructed from the local-budget programme classification using codes 8311 (protection and rational use of natural resources), 8312 (waste treatment), 8313 (elimination of other environmental pollution), 8320 (preservation of protected areas), 8330 (other environmental-protection activities), 8340 (environmental measures financed from earmarked funds), and 8350 (local public-investment projects in environmental protection) [42].

At the oblast-budget level, a directly observable narrow environmental-protection expenditure measure is available for 2025. According to the official report on the execution of the Zakarpattia Oblast Budget, UAH 1.483 million was spent from the special fund under the Environmental Protection Programme of Zakarpattia Region for 2024-2027. This represented approximately 0.05% of total oblast-budget expenditure excluding transfers to other budgets (UAH 2,730.8 million) and 0.19% of special-fund expenditure (UAH 765.7 million). The amount included UAH 0.100 million for environmental monitoring, UAH 0.139 million for environmental actions, UAH 0.100 million for environmental information materials, and UAH 1.144 million in subventions to territorial communities for environmental measures, including separate-waste collection containers and an energy-efficiency improvement to a secondary-raw-material collection facility [41]. These expenditures provide a narrow observable environmental-protection benchmark and should not be interpreted as the total value of green public procurement in the region.

This environmental-protection expenditure proxy should not be equated with the value of green public procurement. The identified budget-classification codes provide a reproducible basis for estimating a narrow environmental-protection expenditure proxy; however, calculation of its exact share is outside the scope of the present study because expenditure classified under these codes is not equivalent to green public procurement. Environmental criteria may be embedded in procurement recorded under education, construction, transport, energy-efficiency, health-care, or other budget programmes, while expenditure under environmental programme codes may include items that are not public procurement. Accordingly, annual monitoring should report the environmental-protection expenditure share separately from the share of procurement procedures with document-verified environmental requirements. The latter can be calculated reliably only after a complete regional procurement dataset has been formed and verified at level A2. These distinctions also have implications for procurement design. Since regional and fiscal effects depend on the supplier's actual production, employment, subcontracting, and tax-allocation characteristics rather than solely on its place of registration, SME access should be supported through competition-compatible instruments rather than territorial preferences. The study therefore focuses primarily on SME access to green public procurement, while the proposed RVR and SFER indicators are applicable to suppliers irrespective of enterprise size. Table 5 summarises the principal procurement tools that can contribute to these objectives.

Table 5

Procurement Tools for SME Access and Budget Efficiency

Tool	Expected enterprise effect	Expected budget effect	Risk and control
Division into lots	Allows specialised and smaller suppliers to bid for manageable volumes	May broaden competition and reduce supplier concentration	Avoid artificial fragmentation; justify lot structure and permit combined awards where efficient
Joint procurement	Creates predictable aggregated demand and may enable consortium participation	Pools procurement expertise and may reduce transaction costs for smaller communities	Avoid excessive aggregation that excludes SMEs; combine joint procurement with lots and allow joint bids or consortia
Proportionate qualification requirements	Reduces unnecessary turnover, staffing, and experience barriers	Expands the pool of capable bidders	Requirements must remain sufficient to control performance risk
Equivalent environmental evidence	Prevents the exclusion of firms that do not hold a specified label when they can demonstrate equivalent performance	Maintains competition while preserving environmental outcomes	Specify measurable criteria and a transparent equivalence assessment
Preliminary market consultations	Gives enterprises time to understand future needs and invest in compliance	Improves specifications and price realism	Ensure equal access to information and prevent preferential treatment
Life-cycle costing	Rewards durable and resource-efficient solutions	Reduces operating, maintenance, and disposal costs where data are reliable	Publish the formula, assumptions, data sources, and evaluation method
Predictable payment terms and post-award control	Reduces SME working-capital pressure and rewards verified performance	Lowers risk premiums and safeguards environmental value for money	Use clear acceptance procedures, timely payment, indicators, and remedies

Source: developed by the authors based on [1; 3; 10; 14; 16-19; 37].

For Zakarpattia Region, the most relevant categories are food and catering, wood and furniture, construction and energy efficiency, waste and water services, and transport-related procurement [3; 5]. Lots and proportionate requirements can reduce scale barriers; the acceptance of equivalent evidence prevents a single specified label from excluding capable suppliers; market consultations improve the realism of specifications; life-cycle costing recognises operating and disposal costs; and predictable payment terms support SME liquidity. Procurement procedures using these instruments must remain open to all qualified suppliers and be combined with measurable post-award control.

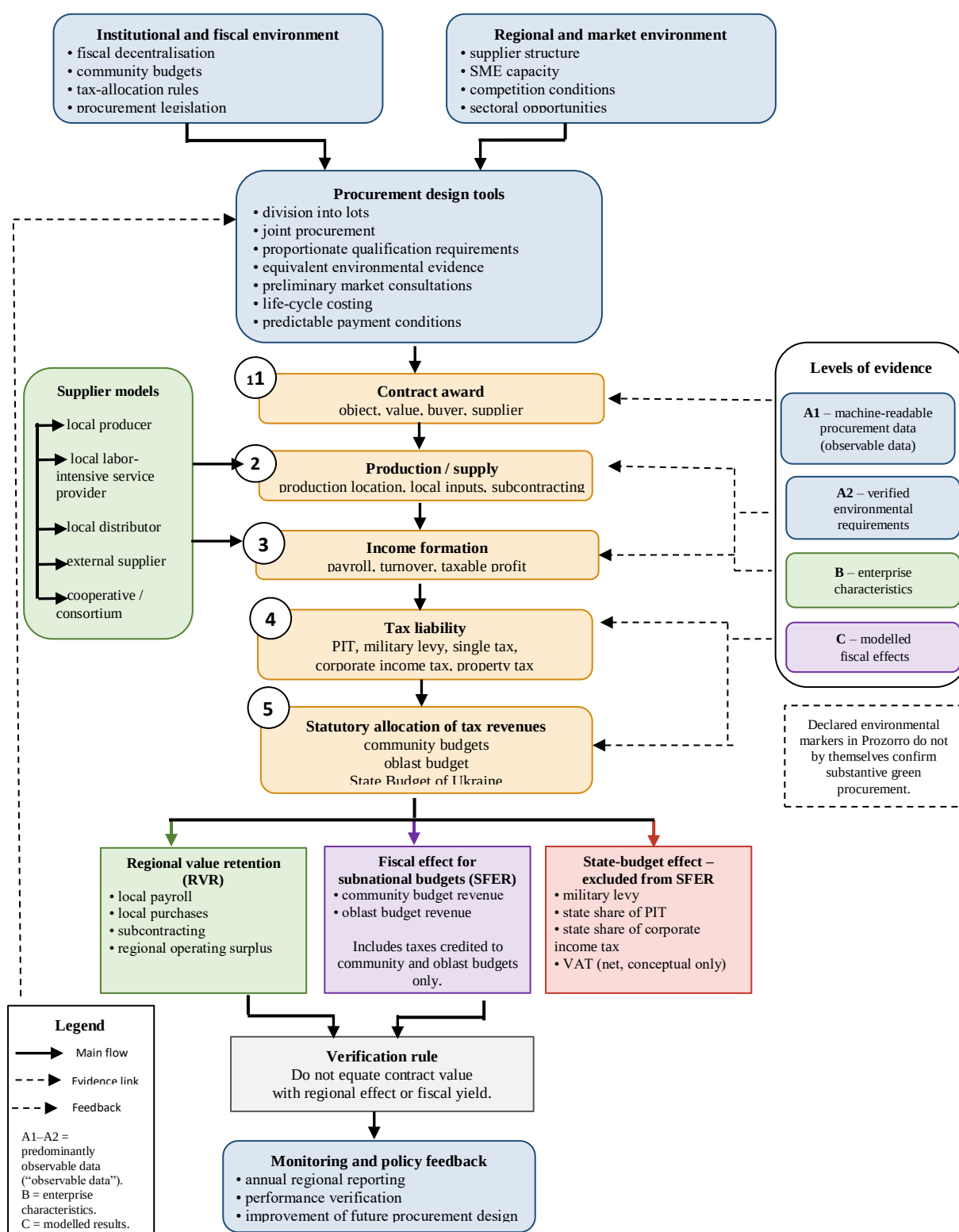


Figure 2. Analytical Framework for SME Access, Regional Value Retention and Subnational Fiscal Effects of Green Public Procurement

Source: developed by the authors

In the framework, solid arrows represent the main economic and fiscal flows, whereas dashed arrows indicate evidence links and monitoring feedback. RVR reflects first-order regional value retention, while SFER includes only tax receipts credited to community and oblast budgets. Military levy, VAT, SSC, and the state-budget shares of PIT and corporate income tax are treated as state-budget or non-local effects and are excluded from SFER. Figure 2 presents the network of institutional conditions, procurement decisions, supplier functions, evidence levels, and fiscal-transmission channels used in the proposed analytical framework.

Regional monitoring should distinguish four evidence levels. A1 contains machine-observable Prozorro data, including environmental markers, lot IDs, values, bids, statuses, and supplier registration. A2 contains environmental requirements and performance verified through tender, contract, acceptance, and performance documents. Level B contains supplier characteristics, including organisational form, functional role, SME status where verifiable, and regional operating footprint. Level C contains modelled RVR and SFER values based on transparent assumptions. This separation prevents a self-declared marker or modelled tax effect from being presented as verified environmental performance or realised regional revenue.

An annual regional report should cover all machine-identified and document-verified environmentally relevant procedures, competition and SME-access indicators, contract performance, supplier characteristics, RVR where enterprise data are available, SFER based on realised or transparently modelled data, and the environmental-protection expenditure proxy defined by budget-classification codes. Implementation requires coordination among procurement, finance, environmental, and enterprise-support units. The transition to Law No. 4888-IX provides an opportunity to prepare standard specifications, market-consultation templates, equivalent-evidence guidance, structured-data rules, SME-access indicators, and contract-performance indicators before most provisions become operational in March 2027 [33].

The findings are consistent with previous studies showing that green public procurement does not necessarily restrict SME participation when environmental requirements are proportionate, transparent, and supported by equivalent evidence [17-19; 37]. The Zakarpattia cases further demonstrate that the structured environmental marker in Prozorro cannot by itself confirm the substantive environmental quality of a procurement procedure [25; 26; 34-36]. The study extends these approaches by separating contract value, regional value retention, and subnational fiscal effects and by linking those distinctions to explicit evidence levels. This is particularly important under fiscal decentralisation because the contracting authority, supplier registration, production, employment, subcontracting, and tax crediting may be located in different jurisdictions.

Conclusions and prospects for further research. During fiscal decentralisation, the nominal financial capacity of territorial communities in Zakarpattia Region expanded considerably. Between 2020 and 2025, general-fund



own-source revenue excluding interbudgetary transfers increased from UAH 5,352.0 million to UAH 12,366.6 million, an increase of 131.1%. However, differences in local tax bases and administrative capacity continue to affect communities' ability to design and implement technically demanding green public procurement. The study focuses primarily on SME access, while the proposed fiscal-transmission indicators can be applied to suppliers of any size.

The analysis shows that contract value cannot serve as a universal measure of regional economic or fiscal impact. The author-developed RVR indicator measures first-order regional retention through verified payroll, purchases, subcontracting, and operating surplus, whereas the author-developed SFER indicator measures tax receipts credited to community and oblast budgets under statutory allocation rules. Sensitivity analysis demonstrates that SFER varies materially with employment intensity, supplier tax regime, taxable margin, and tax-allocation rules; therefore, modelled values must be reported as scenarios rather than realised fiscal effects.

The verified marker-based cases show that a structured environmental marker should not be interpreted as evidence of substantive green performance. The A1-A2-B-C hierarchy separates machine-readable declarations, document-verified environmental requirements, supplier characteristics, and modelled regional and fiscal effects. The completed battery case also illustrates that a procurement contract awarded by a regional contracting authority may involve an external distributor-type supplier and therefore does not automatically generate equivalent regional value retention. Procedures that do not result in a contract remain relevant to procurement-design analysis but cannot generate realised RVR or SFER.

The scientific novelty of the study lies in integrating four elements within a single regional analytical framework: (1) the author-developed RVR indicator; (2) the author-developed SFER indicator; (3) a functional supplier typology; and (4) the A1-A2-B-C evidence hierarchy. Unlike approaches centred mainly on procurement volume, supplier participation, or broader local-spending multipliers, the proposed framework explicitly separates contract value, first-order regional value retention, tax receipts credited to subnational budgets, and the level of empirical verification. RVR is conceptually informed by local-retention approaches such as LM3 [38] but is deliberately restricted to the first-order contract transmission channel, while SFER is constructed specifically from Ukrainian statutory tax-allocation rules [30-32].

For procurement practice, communities should use justified lotting, proportionate qualification requirements, joint procurement where appropriate, preliminary market consultations, equivalent evidence of environmental compliance, predictable payment conditions, and life-cycle costing. Further research should develop a comprehensive regional dataset covering all machine-identified and document-verified environmentally relevant procedures and link completed contracts to enterprise-level information on SME status, production location, payroll, local purchases, subcontracting, and contract-level operating results. This would allow RVR and SFER

to be estimated ex post rather than through scenarios and would support direct comparison of the regional effects of different supplier models.

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