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MARKET-BASED MANAGEMENT OF FERTILE TOPSOIL ACCUMULATED FROM THE AKHURYAN RESERVOIR BASIN: A SYSTEMIC MODEL FOR VALUATION, LOT FORMATION, PUBLIC SALE, REVENUE DISTRIBUTION, AND LEGAL REFORM

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ACCUMULATED FROM THE AKHURYAN RESERVOIR BASIN: A
SYSTEMIC MODEL FOR VALUATION, LOT FORMATION, PUBLIC
SALE, REVENUE DISTRIBUTION, AND LEGAL REFORM**

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Abstract

The article develops a scientific and practical model for the legal and economic circulation of 212,532 m³ of fertile topsoil that has been stockpiled in the vicinity of the Akhuryan Reservoir for approximately four decades. According to field measurements and laboratory analyses conducted in 2026, the average humus content of the stockpiled soil is 3.54%, compared with 4.54% in the background soil. This finding confirms the high resource potential of the stockpile but does not justify classifying the entire volume uniformly as *chernozem* without additional vertical and horizontal sampling.

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The legal-dogmatic analysis shows that Article 36 of the Land Code of the Republic of Armenia and Government Decision No. 676-N permit the sale of fertile topsoil removed during construction activities and provide that the entire proceeds from the sale of topsoil obtained from state- and community-owned land plots be allocated to the community budget. At the same time, the existing regulatory framework does not establish a comprehensive mechanism for competitive price formation, public lot formation, earmarked use of revenues, or identification of ownership of long-standing historical stockpiles.

A two-stage solution is proposed: first, an immediately applicable open electronic auction, with quality-based grading and a starting price separated from logistics costs; and second, a legislative reform establishing a dedicated Land Resource Restoration Subaccount. Scenario-based valuation indicates that, within the considered price range of AMD 4,000–8,000/m³, the gross value of the stockpile amounts to approximately AMD 850.1 million–1.700 billion. However, this range cannot be mechanically adopted as an official price, since it requires comparable adjustments for legally documented transactions, soil quality, VAT, loading, and transportation conditions.

The study combines legal-dogmatic analysis, a synthesis of international Scopus-indexed literature, quality-adjusted comparative and residual valuation methods, scenario sensitivity analysis, and a multidimensional public net value model. Given the availability of only a single stockpile and unverified informal price observations, econometric coefficients are not estimated. Instead, an identifiable hedonic valuation model is formulated for future microdata generated through legally conducted auctions.

Keywords: fertile topsoil, chernozem, natural capital, public auction, pricing, community budget, land restoration, circular economy, Akhuryan Reservoir.

Introduction

The fertile topsoil layer is not an ordinary movable commodity. It constitutes a slowly forming form of natural capital whose private economic value is intertwined with public values related to food security, ecosystem services, erosion prevention, and carbon storage. Consequently, introducing it into market circulation should not be regarded as privatization for its own sake; a legally sound model must simultaneously prevent the dissipation of the resource, reveal actual demand, and ensure its targeted use [1].

The 212,532 m³ stockpile recorded in the territory of Aghin settlement, adjacent to the Akhuryan Reservoir, is distinctive for three reasons. First, it is a historical stockpile that has been stored for approximately 40 years. Second, the scale of the stockpile is nearly eight times greater than the combined 27,309 m³ flow of legally identified demand and illegal removal recorded in the report for 2025. Third, the stockpiling area encompasses land plots with different legal statuses; therefore, the location of the soil does not, in itself, automatically determine the ownership of the soil mass once it has become movable property.

Contemporary research considers long-term stockpiled topsoil to be a recoverable but qualitatively variable secondary soil resource. Valliere et al. demonstrate that plant growth and water-use efficiency may deteriorate even when conventional chemical analyses reveal no substantial differences. Fischer et al. confirm depth-related differences in nutrient availability and microbial communities. Amir et al. further associate the effects of stockpiling with changes in microbial diversity, while D'Agui et al. substantiate the need for multidimensional

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biological assessment. The 2025 findings of Ledesma et al. highlight the importance of vertical heterogeneity within deep stockpiles [3-6].

The international policy framework follows the sequence: “inventory → characterization → classification → conditioning → matching to end use → controlled reuse → monitoring.” The UK DEFRA Code requires the separation of topsoil and subsoil and the protection of soil structure. New South Wales gives preference to direct soil return, while stockpiling is regarded as a resource for future land rehabilitation. The EU Joint Research Centre (JRC) incorporates the reuse of excavated soils into the framework of the circular economy and life-cycle costing. The experience of Helsinki demonstrates the potential of digital supply–demand coordination and closed-loop soil reuse in public procurement [7-11].

Topsoil Stockpiling and Changes in Functional Quality

A key conclusion of contemporary international literature on fertile topsoil is that stockpiling is not a neutral practice. Justin Valliere, Haylee D’Agui, Kingsley Dixon, and co-authors demonstrated in *Plant and Soil* that plant growth, water-use efficiency, and the formation of nitrogen-fixing root nodules decline in stockpiled soils, even when individual physicochemical parameters show no substantial differences. Therefore, an average humus content of 3.54%, although an important indicator, is not sufficient evidence in itself to classify the entire 212,532 m³ stockpile as high-quality agricultural chernozem [7].

Haylee D’Agui and co-authors, in *Restoration Ecology*, simultaneously compared microbial community structure, biological activity, and a plant-growth bioassay. Their findings demonstrate that different biological indicators may lead to different conclusions regarding the same soil. For the Akhuryan stockpile, this implies that valuation should be based not on a single indicator, but on an integrated profile combining physical, chemical, biological, and plant-growth characteristics [3].

Pamela Block, Kaylee Gush, and Ryan Limb, in their study of long-term stockpiled grassland soils published in *Applied Soil Ecology*, documented changes in the abundance and composition of microbial communities. Importantly, depth within the stockpiled soil mass may be a determining factor: the properties of the upper, aerated layer cannot be mechanically extrapolated to the middle and deeper layers of the stockpile [12].

Jamie Ledesma, Joseph Neilson, Raina Maier, and co-authors, in their 2025 study, used boreholes extending to depths of more than 20 m to identify vertical biogeochemical heterogeneity resulting from long-term stockpiling. Their approach is particularly relevant to the characteristics of the historical Akhuryan stockpile and supports the need for three-dimensional inventorying and depth-stratified sampling [6].

Ashley Fischer, Jay P. Singh, Jonathan Van Hamme, and co-authors demonstrate that microbial community structure and diversity vary with stockpile height and depth. This finding is important not only for environmental assessment but also for economic valuation: quality heterogeneity implies that assigning a single uniform price to the entire stockpile would constitute a valuation error; therefore, the stockpile should be marketed in quality-homogeneous lots [5].

Excavated Soil as a Secondary Resource in the Circular Economy

Sarah Hale, António José Roque, and co-authors, in their assessment of international practices for the reuse of soils generated by construction and demolition projects, identify four

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major barriers: fragmented regulation, uncertainty regarding material quality, logistical mismatches, and the lack of supply–demand coordination. In the Akhuryan case, all four barriers are present simultaneously: the stockpile has been inventoried, but there is still no classified marketable product, transparent price signal, or digital marketplace connecting potential end users [13].

Benedetto Rugani and Claudio Petucco, using a spatial life-cycle model in *Science of the Total Environment*, demonstrate that the local reuse of excavated soil can substantially reduce the environmental burden associated with transportation and disposal. Therefore, maximizing the market price of the Akhuryan stockpile should not result in sales to distant destinations where tonne-kilometre-related emissions outweigh the environmental benefits of reuse. Under an auction-based system, a logistics-related carbon indicator should be disclosed, while in tenders for public projects it should be incorporated into the evaluation criteria [2].

The study conducted by the European Commission’s Joint Research Centre (JRC) conceptualizes excavated soil as a circular material flow and integrates life-cycle assessment (LCA) with life-cycle costing (LCC). Under this approach, the sale price does not represent the full social value of the resource. Decision-making therefore requires an integrated assessment of monetary revenue, the value of substituted primary soil resources, avoided disposal, carbon impacts, and the ecosystem benefits generated by restored land [9].

Soil Quality, Natural Capital, and Pricing

Oshadi Samarasinghe and Suzie Greenhalgh, using a hedonic approach in *Soil Research*, demonstrated that intrinsic soil characteristics—such as drainage, rooting depth, and water availability—are reflected in the value of agricultural land. Their findings support the use of quality adjustment coefficients. However, the price of a movable stockpile of fertile topsoil cannot be derived directly from the per-hectare sale price of agricultural land, because the values attributable to location, development potential, and property rights must be excluded [14].

Luise Meißner and Oliver Mußhoff, in a study published in *Q Open* using German data for 1991–2020 and FMOLS and DOLS estimators, demonstrated a long-run relationship between soil quality and agricultural land prices. This finding provides an important theoretical basis for the quality-adjusted valuation of the Akhuryan stockpile, but it cannot substitute for data from legally documented local transactions. Directly transferring internationally estimated coefficients to the Armenian market would be econometrically unjustified [15]. Kritika Sen Chakraborty, Avinandan Chakraborty, and Robert P. Berrens, in a study published in *World Development*, used a hedonic model to estimate the value of investments in soil erosion control. An important implication of their research is that market land prices may capitalize some soil conservation attributes, while public ecosystem benefits are not fully reflected in private willingness to pay. Therefore, reserving a portion of the stockpile for public land restoration outside the market auction mechanism should not be regarded as contrary to economic efficiency [16].

Auction Design, Competition, and Public Revenue

Pantelis Koutroumpis and Martin Cave, in a study published in the *Journal of Regulatory Economics* based on data from 371 auctions across 85 countries and more than

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10,000 lots, demonstrated that auction design has a significant effect on final normalized revenues, while administrative allocations generally provide a weaker mechanism for revealing the true value of a scarce resource. Although their study focuses on radio spectrum, its institutional implication is also applicable to the Akhuryan case: a divisible and scarce resource under public control should not be allocated on a large scale through individually negotiated arrangements [17].

Decio Coviello and Mario Mariniello, in a study published in the *Journal of Public Economics*, used a natural experiment to demonstrate that increased publicity of auctions raised the number of participants and improved price outcomes for the government. This finding supports not merely compliance with minimum legal notice requirements, but the establishment of a comprehensive data room containing laboratory reports, maps, the draft contract, questions and answers, and machine-readable auction results [18].

Paul Klemperer's seminal work on auction design emphasizes that the optimal auction is not a technical format that can be applied independently of context; rather, priority should be given to preventing insufficient participation, collusive behavior, and barriers to entry for new bidders. Therefore, selling the Akhuryan stockpile as a single large lot does not guarantee a higher price; instead, it may restrict competition and create market power for a single buyer [19].

The synthesis of this literature leads to the article's central theoretical proposition: the optimal management of the Akhuryan stockpile is not a simple choice between «selling» and «free allocation». Rather, it is a sequential decision-making process comprising clarification of legal ownership, quality-based segmentation, reservation for public land restoration, competitive lot formation, auction-based price discovery, and the earmarked reinvestment of net proceeds.

Natural Capital and the Informational Limitations of Informal Prices

An informal price provides information about scarcity and effective demand, but does not constitute legal or valuation evidence. It may incorporate a risk premium associated with illegal extraction, unknown quality, loading and delivery costs, tax avoidance, or, conversely, a high retail margin. Therefore, the AMD 4,000–8,000/m³ range is used in this article solely as an observed price signal and a scenario range, rather than as an automatic basis for determining the starting price.

Scientific Novelty of the Study

- The legal characterization of a long-standing historical stockpile is linked not merely to its designation as “chernozem,” but to its current functional quality and origin.
- A quality-adjusted residual value formula is proposed, separating the value of the soil itself from loading, transportation, and restoration costs.
- A dual-track allocation model is developed: auctioning of commercial lots, and competitive selection/public allocation for projects that commit to measurable land-restoration outcomes.
- Revenue distribution is structured through a two-tier legal framework: under the currently applicable Government Decision No. 676-N, 100% of the proceeds are allocated to the community budget, while intergovernmental revenue-sharing formulas would become possible only following legislative amendments.

Conflict Setting

The research question is as follows: Is it economically rational and legally justified to continue allocating this high-value stockpile through administrative distribution without

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competitive price discovery, given that informal market offers range from AMD 4,000 to 8,000/m³, and what institutional model can effectively integrate legality, economic efficiency, social equity, and environmental outcomes?

Data and methodology

The primary empirical basis of the study comprises field measurements of the stockpiling area, cadastral data, sampling conducted on March 24, 2026, and results obtained from an accredited laboratory. The study applies legal-dogmatic, systemic, and teleological interpretation, comparative institutional analysis, scenario-based valuation, sensitivity analysis, and multidimensional decision-making logic. The article does not substitute for a definitive legal determination of property ownership; prior to any sale, a separate legal audit of the chain of provenance and ownership status of each sub-area is required.

Table 1

**Key Quantitative and Qualitative Indicators of the Fertile Topsoil Stockpile
in the Vicinity of the Akhuryan Reservoir**

Indicator	Value	Comment
Estimated volume	212,532 m ³	Result of field measurements reported in the study
Stockpiling area	approx. 2.52 ha	Includes land plots with different cadastral statuses
Average humus content	3.54%	High/good agricultural potential
Background humus content	4.54%	Natural reference value
Relative difference	-22.0%	$(3.54/4.54 - 1) \times 100$
Legal applications in 2025	2,716 m ³	20 applications
Illegal removal	24,593 m ³	Recorded through monitoring and enforcement activities
Observed informal price	AMD 4,000–8,000/m ³	Delivery and tax conditions not verified

Source: Compiled from the 2026 report on the Akhuryan stockpile and the authors' calculations.

The unit value should be estimated by combining at least three approaches: comparable sales, cost/replacement value, and residual value. The income approach is applicable only to those end uses for which incremental crop yields or savings in landscaping costs can be reliably quantified.

$$P_i = \max\{P_i^{\text{cost}}, \tilde{P}^{\text{comp}} Q_i L_i - C_i^r - R_i\} \quad (1)$$

where P_i - is the estimated ex-stockpile price per 1 m³ of soil in quality class; P_i^{cost} - the minimum recoverable cost of inventorying, testing, safe storage, and sale; $\tilde{P}^{\text{comp}}$ - is the median price of legally documented and comparable transactions; Q_i - is the quality adjustment coefficient; L_i - is the location/accessibility coefficient; C_i^r - is the required conditioning cost; and R_i - is the discount reflecting legal, contamination, and marketability risks. Transportation is treated separately and borne by the buyer, so that the logistics costs of distant purchasers do not distort the price of the public asset.

$$V = \sum_{i=1}^n q_i P_i - C_0 - \sum_{i=1}^n q_i c_i \quad (2)$$

Here, q_i - is the volume sold, C_0 - is the fixed preparatory cost, and c_i - represents the variable costs of measurement, loading, monitoring, and transaction administration. This formulation distinguishes gross revenue from the community's net public benefit.

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Quality Classification

The economic utilization of the stockpile requires the formation of quality-homogeneous lots. The classification presented below links measurable soil characteristics to permissible end uses and the corresponding price-adjustment ranges.

Table 2

Quality Classification, Intended Uses, and Price-Adjustment Coefficients for Fertile Topsoil

Class	Mandatory Criteria	Primary Use	Price Adjustment Coefficient (Q)
A	No contamination; adequate soil structure; high organic matter content; positive bioassay results	Improvement of agricultural soils	1.00–1.20
B	Safe, but requires structural and/or biological conditioning	Land reclamation, afforestation, urban greening	0.70–0.95
C	Limited functionality; suitable for controlled technical applications	Landscape cover and slope stabilization after improvement	0.35–0.65
X	Contamination or non-compliance	Sale prohibited; special management required	0

The methodological framework is based on the studies of Valliere et al. (2022), D'Agui et al. (2022), Hale et al. (2021), Rugani and Petucco (2025), Cristóbal et al. (2024), Samarasinghe and Greenhalgh (2013), Meissner and Musshoff (2022), and Chakraborty and Chakraborty (2023), as well as Government Decisions No. 124-N and No. 676-N of the Republic of Armenia.

Feasibility and Limitations of Econometric Estimation

The structure of the available data does not permit the reliable estimation of an econometric model with empirically derived coefficients. The analysis concerns a single stockpile, while the AMD 4,000–8,000/m³ range is based on market observations and does not constitute a series of transaction-level microdata. Estimating a regression model using only a few assumed prices would create an illusion of numerical precision. Accordingly, econometric analysis is presented in this article as an estimation strategy to be applied after pilot sales have generated sufficient data, rather than as an already obtained empirical result.

Consequently, the AMD 5,000 and AMD 2,000 payments, the 15% profitability threshold, the quality coefficients, and the quantitative limits imposed on individual lots presented below are normative scenario-based parameters rather than empirically estimated optima. Their final values should be recalibrated using data from pilot auctions and subjected to sensitivity analysis.

Once a unified database of auction results and legally documented contracts has been established, the hedonic price per 1 m³ can appropriately be estimated using the following semi-logarithmic model:

$$\ln P_{jt} = \alpha + \beta_1 H_j + \beta_2 SOC_j + \beta_3 pH_j + \beta_4 EC_j + \beta_5 D_j + \beta_6 \ln Q_j + \beta_7 C_t + \mu_m + \tau_t + \varepsilon_{jt} \quad (3)$$

where P_{jt} - is the final price of lot j at time t ; H - denotes humus content; SOC - represents soil organic carbon; pH - and EC - denote soil acidity and electrical conductivity, respectively; D - is the distance to the buyer's intended destination; Q - is the lot volume; C - is an indicator

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of auction competition; μ_m - captures use- or region-specific fixed effects; and τ_t represents time fixed effects. Standard errors should be clustered at the auction level.

This model will subsequently make it possible to determine empirically whether smaller lot sizes and more comprehensive quality disclosure enhance price competition. Until sufficient empirical evidence becomes available, the starting price should be based on an independent valuation and a pilot auction [20].

Measurement of Public Net Value and Multidimensional Efficiency

$$NPV_s = \sum_{t=0}^T \frac{R_t - C_t - E_t + B_t}{(1+r)^t} \quad (4)$$

Here, R_t - represents revenues from sales and avoided disposal costs; C_t - denotes the costs of inventorying, testing, loading, and management; E_t represents transportation costs and potential environmental externalities; B_t . denotes the measurable ecosystem benefits generated by restored land; and rr is the social discount rate. This calculation avoids the erroneous assumption that the option yielding the highest nominal sale price is automatically the most efficient alternative.

$$W_k = 0.35NREV_k + 0.25LAND_k + 0.15COMP_k + 0.15TRACE_k + 0.10CARB_k \quad (5)$$

For comparing alternative options, a normalized multidimensional index on a 0–100 scale is proposed, where NREV represents net community revenue, LAND denotes land-restoration outcomes, COMP reflects the level of competition, TRACE represents traceability, and CARB denotes carbon efficiency. The weights assigned to these dimensions are a matter of policy choice and should be established through public consultation; however, their ex ante disclosure limits ex post discretion.

Assessment of the current legal framework

Permissibility and limits of sale

Under the current wording of Article 36(5) of the Land Code of the Republic of Armenia, the sale of fertile topsoil removed during mineral extraction activities is prohibited, whereas the procedure for the sale of fertile topsoil removed as a result of construction activities is established by the Government. Government Decision No. 676-N constitutes this specific regulatory framework: it requires authorization from the head of the community, documentation issued by an accredited laboratory and submitted by the seller, a sale and purchase agreement, designated end use, and proper record-keeping [21, 22].

For the Akhuryan stockpile, it is essential to document that the soil mass was removed as a result of reservoir construction rather than mineral extraction activities. In addition, it must be established who owned the land at the time of removal, who carried out the removal and subsequent stockpiling, and whether ownership of the stockpiled soil was subsequently transferred. The current owner of the cadastral land plot is not necessarily, by virtue of that fact alone, the owner of the soil that has been removed and transformed into movable property. This legal audit constitutes a mandatory “Phase Zero” prior to the auction.

Legal and Economic Assessment of Free Allocation

The primary environmental function of fertile topsoil is to improve degraded, disturbed, or less productive land. Therefore, free allocation is not inherently irrational,

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provided that it serves a pre-approved public land-restoration programme, delivers measurable outcomes, applies a transparent beneficiary-selection process, and includes post-use monitoring. However, the complete administrative allocation of a high-value, commercially usable stockpile that substantially exceeds existing demand, without competitive selection, fails to ensure adequate compensation for public property, creates risks of selective preferential treatment and informal resale, and is inconsistent with the objectives of efficient and accountable resource management.

Accordingly, a legally sound policy should distinguish between two allocation streams. A public restoration reserve may be allocated free of charge or on subsidized terms through a competitive, results-based procedure, whereas lots intended for commercial and private use should be sold through public auction. Recipients of free allocations should be prohibited from reselling the soil, while its actual use should be verified through geographic coordinates, an acceptance certificate, and monitoring for at least one season.

Auction or Competitive Tender?

Under the Law of the Republic of Armenia “On Public Auctions,” the winner of an auction is the bidder offering the highest price, whereas in a competitive tender, the winner is the participant offering the best terms and conditions. Therefore, the choice of instrument should be determined by the objective pursued rather than by administrative preference.

Table 3

**Comparative Assessment of the Intended Application
of Auction and Competitive Tender Mechanisms**

Objective	Recommended Mechanism	Winner Selection Criterion	Rationale
Commercial sale	Open electronic ascending-price auction	Highest price	The resource is classified and comparable
Public land reclamation	Open competitive tender or two-stage tender	Best price–outcome combination	Location, restoration outcomes, and co-financing are important
Access for small farmers	Auction of standardized small lots with quantity limits	Highest price, subject to a per-buyer quantity cap	Prevents concentration of the entire stockpile in the hands of a single buyer
Urgent environmental need	Justified targeted allocation	Public necessity	Exception subject to full public disclosure

Source: Author’s compilation based on the provisions of the Law of the Republic of Armenia “On Public Auctions.”

The proposed primary mechanism is an open electronic ascending-price auction. A competitive tender is appropriate not for ordinary sales, but for lots where the community also seeks to obtain a public benefit, such as the restoration of eroded land, carbon storage, urban greening, or co-financing. Combining price and qualitative commitments within a single non-transparent evaluation process increases administrative discretion; therefore, tender criteria should be quantified in advance.

Mandatory Destination of Sale Proceeds

Paragraph 5 of Government Decision No. 676-N explicitly provides that proceeds from the sale of fertile topsoil removed from state- and community-owned land plots shall be credited to the community budget. Accordingly, under the current legal framework, a proposal to distribute gross proceeds on a percentage basis among the state, the region, the community,

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and the organizer would not be legally permissible. Nor does the region constitute a separate budgetary beneficiary for the purposes of this specific regulatory framework.

The organizer's remuneration should therefore take the form of a pre-determined service fee or an actually incurred and duly substantiated expense, financed through the community budget and governed by public procurement rules, rather than a share automatically withheld from the sale proceeds [21].

Systemic Interrelationship of the Legal Acts

Article 36 of the Land Code of the Republic of Armenia defines the substantive legal boundaries; Government Decision No. 676-N establishes the specific procedure for the sale of fertile topsoil removed as a result of construction works; Government Decision No. 1396-N sets the requirements for its use and conservation; and Government Decision No. 124-N establishes the minimum safety thresholds for contamination assessment. The Law of the Republic of Armenia "On Public Auctions" applies where the right holder chooses an auction or competitive tender as the contractual allocation mechanism. These legal acts should be applied in conjunction with one another, rather than as mutually substitutable regulatory instruments [22].

The wording in Paragraph 4 of Government Decision No. 676-N, allowing the price to be determined "by mutual agreement," does not preclude the use of a public auction. On the contrary, the highest bid established through an auction constitutes the mutually agreed contractual price between the owner and the winning bidder. In the case of a large publicly controlled stockpile, an auction fills a gap in the specific regulatory framework by ensuring equal access and verifiable price discovery. However, community decisions concerning the use of an auction, approval of lots, and determination of the starting price must be adopted with strict observance of the respective legal competences [22].

The most important legal prerequisite is the establishment of ownership of the stockpile. The current cadastral ownership of the land plot underlying the stockpiled material is not, by itself, sufficient to identify the legal owner of the soil once it has been removed and transformed into movable property. It is necessary to reconstruct the chronology of soil removal, determine the legal status of the client and contractor responsible for reservoir construction, examine soil inventory records and subsequent transfers, and establish whether the stockpile was recognized on the community's balance sheet. Until these issues are resolved, any formula for allocating potential revenues remains conditional.

Solutions Permissible under Current Law and Those Requiring Legislative Amendment

Under the current legal framework, it is possible to commission an independent valuation, divide the stockpile into lots, organize an open electronic auction, credit the entire proceeds to the community budget, and pay for laboratory, organizational, and monitoring services through applicable budgetary and public procurement procedures. It is also possible, through a programme approved by the community council, to earmark net proceeds for land restoration, provided that budget classification requirements and public accountability are maintained.

Legislative amendment would be required to introduce automatic percentage-based transfers of gross proceeds to the state budget or the regional level, direct allocation to the

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organizer of a share of the resource rent generated by the sale, exemptions from the general procedure governing authorization of sales, or the transfer of community revenues to a private extra-budgetary fund. These options are presented in this article as reform scenarios rather than descriptions of the law currently in force.

Price and financial scenarios

Sensitivity of Gross Value

Since no verified transaction price is available for the entire stockpile, its gross value is initially assessed through sensitivity analysis using alternative unit-price scenarios. The table presents indicative valuation ranges rather than projected final proceeds.

Table 4

**Sensitivity of the Gross Value of the Stockpile to
Alternative Price-per-Cubic-Metre Scenarios**

Price, AMD/m ³	Gross Revenue, AMD million	Gross Revenue, AMD billion
3,000	637.6	0.638
4,000	850.1	0.850
5,000	1,062.7	1.063
6,000	1,275.2	1.275
7,000	1,487.7	1.488
8,000	1,700.3	1.700

Source: Author's calculations based on the verified volume of 212,532 m³ and the scenario-based prices.

The scenario of AMD 4,000/m³ yields a gross value of AMD 850.128 million, while AMD 6,000/m³ results in AMD 1.275 billion, and AMD 8,000/m³ in AMD 1.700 billion. Actual proceeds will depend on the shares of Classes A, B, and C, the phasing of sales, the portion reserved for non-commercial public use, and the market's absorption capacity. Offering the entire volume simultaneously could depress the market price and lead to oligopsonistic concentration.

Formation of the Proposed Starting Price

It is proposed that the independent appraiser provide not a single value, but a price range by quality class. For the first pilot auction lot of 5,000–10,000 m³, the preliminary policy range may be set at AMD 3,500–4,500/m³, on an ex-stockpile basis, provided that verification against legally valid comparables and relevant costs supports this threshold. A price of AMD 4,000/m³ may be used as the central pilot scenario rather than as a predetermined final price. A Class A lot may carry a 15–25% premium, Class B may be priced at the base level or at a 10–25% discount, while Class C may be offered at a 35–60% discount.

The auction bid increment is recommended to be set at 2–5% of the starting price, with the bid security/deposit equal to 5% of the lot's starting value. During the first stage, the maximum share that may be acquired by a single buyer should be limited to 20–25% of the volume offered. Following an unsuccessful auction, any reduction in the starting price should be gradual and justified, not exceeding 10% at each subsequent auction, and in no case falling below the cost-recovery floor.

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Logistics and Spatial Pricing

$$P_i^{\text{deliv}} = P_i^{\text{ex}} + C_i^{\text{load}} + d_i t_i + C_i^{\text{loss}} \quad (6)$$

The delivered price is equal to the ex-stockpile price plus loading costs, transportation costs calculated as the product of distance and transport tariff, and costs associated with material losses. In distant markets, transportation costs may exceed the value of the soil itself. Therefore, the auctioned asset should be the soil “ex-stockpile”, while loading and transportation services should either be arranged by the buyer or procured separately under a transparent framework contract.

Practical Algorithm for Determining the Value per 1 m³

The first step is to clearly define the valuation date and the conditions of sale—whether the price refers to 1 m³ of soil available at the stockpile or includes loading, VAT, and delivery. Without such standardization, offers of AMD 4,000 and AMD 8,000/m³ are not directly comparable.

The second step is to collect sales offers and completed transaction data from at least three independent and legally verifiable sources. Informal market advertisements may be included only as a secondary market signal, subject to a substantial risk discount.

The third step is quality adjustment. It is proposed that adjustment coefficients relative to the base price be applied for humus content, organic carbon, salinity, particle-size distribution, bulk density, contamination, and biological test results. The combined effect of these coefficients should not result in an unlimited increase in price. At the initial stage, it is advisable to constrain the overall adjustment coefficient within the range of 0.50–1.25 and subsequently recalibrate it using actual auction results.

$$P_{\text{start},i} = \max\{C_{\text{floor},i}, \tilde{P}_{\text{legal}} Q I_i L_i - RC_i - \rho_i\} \quad (7)$$

where $\tilde{P}_{\text{legal}}$ - is the median of comparable legally verified prices, Q - is the composite quality index, L_i - is the accessibility coefficient, RC_i - represents the required conditioning costs, ρ_i - is the monetary discount reflecting legal and marketability risks, and C_{floor} - is the minimum cost-recovery price covering inventory, laboratory testing, storage, and marketing costs. The use of the median reduces the influence of individual exceptionally high or low price observations.

Proposed Price and Its Legally Appropriate Interpretation

Based on the available materials, AMD 4,000/m³ may serve as a working central scenario for the first pilot auction, but it should not be treated as a final official valuation. In practice, it is advisable to commission an independent appraiser to establish a justified range of AMD 3,500–4,500/m³ for Class B soil on an ex-stockpile basis, with a premium of up to 20% for Class A and a discount of at least 35% for Class C. If legally valid comparables do not support this range, the starting price should be revised accordingly.

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The upper informal-market price of AMD 8,000/m³ may plausibly include small-volume retail sales, loading, urban delivery, and the seller's margin. Applying this price to the entire bulk stock of 212,532 m³ would yield a theoretical value of approximately AMD 1.700 billion, but this may overestimate the stock's actual market absorption potential. A phased auction process allows the market price to be discovered without oversupplying the market all at once.

Demand Absorption and Phased Sales

The 2,716 m³ of documented legal requests in 2025 and the recorded 24,593 m³ of unauthorized removal reported in the study do not imply that sustainable annual effective demand is precisely 27,309 m³.

Unauthorized flows may reflect supply rather than demand, and any double counting of the same cases must be excluded. Nevertheless, these figures indicate that selling the entire 212,532 m³ stock within a single year would not be realistic.

It is proposed to sell no more than 15,000–25,000 m³ during the first year, followed by 25,000–35,000 m³ in the second stage, depending on the results of the auctions, and 30,000–40,000 m³ annually in subsequent years. After each stage, the number of participants, the ratio of final to starting prices, unsold lots, and compliance with the intended end use should be reassessed.

Proposed architecture of the sales process

1. Legal audit of ownership and origin. Map the stockpile by cadastral parcels and document its construction-related origin.
2. 3D geodetic survey and mass balance. Assign each lot a unique identification code, volume, and coordinates.
3. Stratified sampling. Collect samples from the upper, middle, and deeper zones and assess their physical, chemical, biological, and botanical characteristics.
4. A/B/C/X classification and a publicly available "soil passport." Provide laboratory test reports, photographs, volume, restrictions, and designated end uses.
5. Public-needs allocation plan. Set aside in advance a 15–25% restoration reserve, to be used exclusively for approved projects.
6. Lotting. Establish small lots of 50–100 m³, medium lots of 500–1,000 m³, and large lots of 5,000–10,000 m³ to ensure diversity among potential buyers.
7. Electronic notification and auction. Publish the complete data package, declarations of conflicts of interest, and questions and answers.
8. Weighing/volumetric measurement and digital dispatch documentation. Link each outgoing vehicle to the relevant contract and designated destination.
9. Post-use verification. Require a buyer's acceptance certificate, geotagged photograph, and report confirming the intended end use.
10. Annual independent audit. Assess volume discrepancies, prices, revenues, environmental outcomes, and complaints.

Minimum Data Disclosure Package

- Lot volume, classification, sampling scheme, and the complete laboratory test report;

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- Starting-price valuation report, including comparable prices and applied adjustments;
- Loading and transportation conditions, restrictions, and responsibilities;
- Participants, bid history, winning bidder, and final sale price;
- Amount paid, revenue transferred to the community budget, and a report on the targeted use of the proceeds.

Preferred Auction Format and Anti-Concentration Rules

For commercial lots, the preferred format is an open electronic English auction with ascending bids. This format is straightforward for participants, makes price competition transparent, and reduces discretion associated with closed valuation procedures. A sealed first-price bid may be used only where the risk of collusive behavior is high and the number of participants is sufficient; however, a single-round sealed bid is more vulnerable to information asymmetry.

To prevent concentration of the stock in the hands of a single large buyer, during the first two stages it is proposed to impose a maximum quantitative limit of 20% per group of related persons, require disclosure of beneficial owners, and prohibit the consolidation of lots until compliance with the contractual intended-use requirement has been confirmed. 10–15% of the small lots may be reserved for farms or other entities requiring up to 200 m³, without directly subsidizing the price.

A competitive selection procedure should be applied to the public restoration reserve. The proposed evaluation weights are: ecological priority of the area to be restored – 35%; own co-financing – 25%; efficiency of soil use per hectare – 15%; logistical carbon efficiency – 15%; and monitoring and maintenance plan – 10%. Selection of the winner should not be based on a generic formulation such as the “best offer.”

Exceptional Cases of Free-of-Charge Allocation

Free-of-charge allocation is economically justified only where the community effectively obtains a public benefit of at least equivalent value.

The recipient should submit a land restoration project, the legal basis for use of the receiving site, a calculation of the required volume, its own financial contribution, and a commitment to subsequent maintenance. The soil should not be allocated merely on a first-come, first-served basis, since such a procedure does not compare public benefits and increases the risk of resale.

The contract for a free-of-charge or subsidized lot should include a prohibition on resale or other disposal, a deadline for the intended use, the right to conduct on-site inspections, an obligation to return any unused volume or pay its market value, and liability for compensation for any environmental damage caused.

OPTIMAL OPTIONS FOR REVENUE DISTRIBUTION AND USE

Option A. Community-Based Earmarked Management under the Existing Legal Framework (Preferred)

Under the existing legal framework, revenue allocation should be distinguished from the initial budgetary receipt of proceeds and their subsequent program-based expenditure. The following table presents a directly applicable community-level model.

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Table 5

**Community Model for the Allocation of Sales Proceeds
in Compliance with the Existing Legal Framework**

Flow	Proposed Share	Legal Form
Gross sales revenue	100% to the Ani Community budget	Mandatory requirement under Decision No. 676-N
Organizational, laboratory, and audit costs	At actual/competitively determined cost; target: $\leq 10\%$	Budget allocation and procurement contract
Land restoration and irrigation	50% of net revenue as a policy target	Program/sub-budget approved by the Council of Elders
Infrastructure in Aghin and adjacent settlements	20%	Community program
Reserve and stockpile maintenance	15%	Annual budget
Social support/co-financing for small farmers	15%	Program based on transparent eligibility criteria

Source: Author's proposal based on Paragraph 5 of RA Government Decision No. 676-N.

In this option, the percentages refer to intra-budgetary programming within the community budget, rather than to the distribution of proceeds at the time of sale. The model is fully applicable while maintaining the existing special regulatory framework, provided that the Council of Elders adopts an earmarked program and an annual report.

Option B. Community–State Co-Financed Land Restoration Fund

Following legislative amendments, the following allocation could be established: 70% to the community, 20% to a national land restoration fund, 5% to a competitive funding window for regional programs, and up to 5% for administration and oversight costs. This model is appropriate only if the state's share is reinvested in measurable land-conservation projects within the same region. Otherwise, it may weaken the incentives of the community that owns the resource. The regional share should not constitute revenue freely disposable by the regional administration, but rather a program-based allocation.

Option C. Environmental Outcome-Based 60/30/10 Model

Under this model, 60% of net proceeds would remain available for community development and land restoration programs, 30% would form a competitive national “soil circularity” fund, and 10% would cover classification, the digital database, monitoring, and independent auditing.

A private company acting as the organizer would not receive a share of the resource rent. Instead, it would be paid a performance-based service fee, for example capped at 2–4% of verified transactions, but only following competitive procurement and subject to savings/revenue KPIs. Implementation of this option would require amendments to Decision No. 676-N and the relevant budgetary regulations.

Performance Criteria for the Effective Use of Proceeds

Earmarking the funds for specific purposes is not sufficient; it is also necessary to measure the outcomes achieved through their use. The indicators summarized below combine financial returns, competition, traceability, and environmental performance.

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Table 6

Performance Indicators and Proposed Targets for the Use of Proceeds from Sales

Criterion	Formula / Indicator	Proposed Target
Net recovered value	(Revenue – all costs) / m ³ sold	Increasing across successive stages
Price discovery	Final price / starting price	≥1.05, provided there is sufficient competition
Competition	Valid bidders per lot	At least 3
Intended use	Verified volume used / volume sold	≥95%
Community return	Expenditure on restoration / net revenue	≥50% under Option A
Loss	Recorded volume – sold volume – remaining stock	≤2%
Carbon efficiency	CO ₂ e/m ³ or tonne·km	Annual reduction

Source: Author's synthesis based on the analysis of legal, economic, and environmental risks.

Within this system, effectiveness is measured not by the largest amount of expenditure, but by the verified land-conservation outcome achieved per unit of net revenue. Publication of these indicators will make it possible to compare programs and revise priorities accordingly.

Four Legally Compatible Scenarios for Revenue Allocation

Scenario 1 – Existing legal framework and full allocation to the community. One hundred percent of gross revenue is transferred to the Ani Community budget. Administrative and organizational costs are paid separately under procurement contracts, while at least 50% of net revenue is allocated, through a program approved by the Council of Elders, to land restoration, irrigation, and green infrastructure. This is the immediately applicable option with the lowest legal risk.

Scenario 2 – Community revenue with a performance-based organizer. Gross revenue remains 100% community revenue, while the organizer's contract provides for a fixed base fee and a performance-based bonus of up to 2%, applicable only to additional net revenue generated above the initially appraised value. Total remuneration should be subject to a monetary cap to prevent the organizer from effectively becoming a co-recipient of the natural-resource rent.

Scenario 3 – 70/20/5/5 formula following legislative amendments. Under this scenario, 70% is allocated to the community budget, 20% to a targeted national land-restoration program, 5% to competitive inter-community projects in Shirak Region, and a maximum of 5% to inventory, monitoring, and administration. This option may promote territorial solidarity, but only if the national and regional shares do not become non-transparent sources for financing general expenditures.

Scenario 4 – 60/30/10 natural-capital model. Under this model, 60% remains within the community, 30% is allocated to a national revolving land-restoration fund, and 10% is used for data management, laboratory testing, auditing, and the digital management system. This model is more systematic for managing national stocks amounting to millions of cubic metres, but for the single Akhuryan stockpile it may create a disproportionate administrative burden.

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Principles for the Earmarked Use of Sales Proceeds

The first principle is additionality: the proceeds should not replace already approved mandatory community expenditures, but should generate additional land-conservation outcomes.

The second principle is intergenerational equity: revenue derived from the sale of non-renewable or slowly renewable natural capital should not be allocated entirely to current consumption.

The third principle is territorial return: Aghin settlement and the area directly affected by the stockpile should receive tangible benefits.

For each program, it is proposed to publish both input and outcome indicators, including hectares restored, changes in humus content, reduction in erosion, improvement in irrigability, survival rate of plantings, cost per hectare, and three-year maintenance costs. The amount of money spent alone is not an indicator of effectiveness.

Annual programming of the proceeds should be accompanied by an independent financial and performance audit. The audit should reconcile the volumes sold with the volumes actually transported, contractual and budgetary revenues, organizational costs, and the achieved restoration outcomes.

DISCUSSION

The Akhuryan case reveals the principal strengths and weaknesses of the existing regulatory framework. Its strength lies in the fact that the sale already has a legal gateway comprising community authorization, laboratory documentation, a contract, record-keeping, and transfer of proceeds to the community budget. Its weakness is that “mutual agreement” is not a sufficient price-discovery mechanism for a large public stock. Bilateral agreement may be appropriate for small and occasional volumes originating from construction sites, but for a public resource of 212,532 m³, it should be supplemented by public bidding, independent valuation, and conflict-of-interest controls.

Maximizing sales revenue is not the sole criterion of optimality. If all Class A material is purchased by a distant landscaping company offering the highest price while local eroded lands remain unrestored, the overall public benefit may be lower. Therefore, the proposed 15–25% public reserve, combined with auctioning of the commercial share, provides a balance between resource rent and ecosystem outcomes.

At the same time, extensive use of free-of-charge allocation may displace the legal market and encourage resale. Under a targeted competitive selection procedure, the subsidy should be determined not by the status of the recipient but by the documented public outcome, such as hectares restored, erosion prevented, green area created, or the level of co-financing provided.

Interpretation of the Legal Findings

The principal legal finding of the analysis is twofold. On the one hand, the existing regulatory framework does not prevent market circulation: Article 36 of the RA Land Code and Decision No. 676-N provide a legal basis for the sale of fertile soil removed as a result of construction activities. On the other hand, the same framework does not provide a comprehensive price-discovery mechanism for a large historical stockpile. Determining the

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price by “mutual agreement” may be sufficient for a small and isolated transaction, but in the case of a 212,532 m³ publicly owned resource, it does not ensure equal access for potential buyers or verifiability of the best attainable price.

This gap should not be interpreted as a prohibition on sale. The legally more consistent solution is for the community to reach the contractual agreement envisaged by Decision No. 676-N through a public bidding procedure. In that case, the final auction bid becomes the price agreed between the parties, while the laboratory documentation, intended-use requirement, and authorization of the head of the community continue to apply as specific legal conditions. Thus, a public auction does not replace the special regulatory procedure; rather, it supplements it with a competitive component.

Economic Interpretation of the Pricing Results

The informal range of AMD 4,000–8,000/m³ indicates that fertile topsoil in Armenia has effective demand and generates positive economic rent. However, the breadth of this range also reflects the lack of market transparency: quoted prices may refer to soils of different quality, different lot sizes, loading arrangements, urban delivery, tax conditions, and retail margins. Therefore, extrapolating AMD 8,000/m³ to the entire stockpile would be as unjustified as assigning the resource a zero value.

The pilot starting-price range of AMD 3,500–4,500/m³ is presented in this article as a working decision threshold rather than a definitive appraised market value. The rationale is conservative: the starting price should be high enough to prevent unjustified transfer of public resource rent, but not so high as to reduce the number of bidders and increase the risk of unsuccessful auctions. The only reliable next step for actual price discovery is to conduct pilot auctions involving small and medium-sized lots of comparable quality.

Pricing policy should also respond to the volume supplied to the market. If the entire 212,532 m³ stock is released simultaneously, the resulting supply shock may reduce the final price irrespective of soil quality. A phased sale over 5–7 years is therefore not merely a technical convenience but also an instrument of intertemporal price management. The results of each stage should be used to update the valuation for the subsequent stage, taking into account the final-to-starting price ratio, number of participants, and unsold volume.

Institutional Choice between Auction and Competitive Selection

For commercial use, preference for an auction derives from the uniformity of the evaluation criterion: the quality, volume, and conditions of the lot are standardized in advance, and the highest bidder wins. A competitive selection procedure is more appropriate where the community is not merely selling or allocating soil but also expects an additional public benefit, such as restoration of eroded land, greening, co-financing, or a lower carbon footprint. Where no such additional outcome is expected, evaluation based on vaguely defined “best conditions” merely increases administrative discretion.

The lotting structure may be as important as the starting price. Offering only large lots reduces opportunities for small farms to participate and increases the market power of one or two buyers. Conversely, offering only small lots increases transaction costs. The proposed three-tier lotting system—small, medium, and large lots—balances competition with administrative costs. During the initial stages, the 20% quantitative limit for a single group of

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related persons is intended to preserve a competitive market structure for subsequent sales rather than artificially restrict demand from an efficient buyer.

Revenue Allocation and Reinvestment in Natural Capital

Under Decision No. 676-N, the requirement that sales proceeds be transferred to the community budget is not merely a legal constraint but also a mechanism of local accountability. The community is the principal area affected by the location, storage, and external impacts of the stockpile; therefore, local retention of revenue is justified by the principles of origin and territorial impact. At the same time, using the entire amount for current consumption may undermine intergenerational equity because the asset being sold represents natural capital formed over a long period.

Accordingly, under the existing legal framework, the preferred approach is not an extra-budgetary division of gross revenue but earmarked programming within the community budget. Allocating at least 50% of net revenue to land restoration, irrigation, and green infrastructure converts one form of natural capital into another, more durable form. Scenarios involving fixed national or regional shares should be considered only after legislative amendments and in the context of establishing a national system covering multiple stockpiles.

Policy Transferability and National Scale

The Akhuryan case is exceptional in terms of its volume and duration of storage, but the underlying problem is national in scope. Fertile soil layers generated by road construction, reservoir development, industrial projects, and residential construction are affected by recurring information gaps, including incompatible inventory systems, limited accessibility of laboratory data, locally concentrated demand, and high transportation costs. Therefore, a single successful auction would not constitute a complete solution. A national digital database is needed in which both available stocks and demand are represented using the same quality-classification system.

At the same time, the findings from Akhuryan cannot be transferred to all stockpiles without adjustment. The historical origin associated with reservoir construction, average humus content, stockpile depth, and the distance of Ani Community from major markets create a specific context. A national framework should therefore standardize the valuation procedure, while preserving the price effects of differences in local quality, logistics, and intended end use.

Risks and Mitigation Instruments

The effectiveness of the proposed model depends on the proactive management of ownership, quality, volume, and competition risks. In the following table, each major risk is linked to a specific mitigation instrument.

Table 7

**Key Risks in the Market-Based Management of Fertile Soil
and Corresponding Mitigation Instruments**

Risk	Consequence	Mitigation Measure
Ownership dispute	Invalidity of the auction	Preliminary legal audit and mapping
Quality heterogeneity	Buyer disputes and inappropriate use	Stratified sampling and lot-specific soil passport
Bid collusion	Depressed sale price	Electronic auction and disclosure of relationships among bidders

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Volume misreporting	Budgetary losses	3D model and digital traceability of weighing/dispatch records
Resale or inappropriate use	Environmental damage	Intended-use conditions, GPS-based evidence, and penalties
Market oversupply	Price decline	Phased supply over 5–7 years
Excessive organizer profit	Leakage of public resource rent	Fixed/capped competitively determined fee and transparent disclosure of costs

Source: Author's synthesis based on the analysis of legal, economic, and environmental risks.

The combined assessment of the risks indicates that the most vulnerable stage is not the sale itself, but the verification of ownership and quality prior to the sale. Without these foundations, even a fully transparent public auction cannot guarantee legal certainty or accurate price discovery.

Limitations

The proposed monetary scenarios estimate the potential gross value and do not substitute for an independent valuation. The analysis is limited by the absence of a database of comparable legal transactions, a comprehensive depth-based laboratory map of the entire stockpile, an accurate assessment of bulk density, loading costs, a transaction-specific determination of the applicable tax regime, and a stated-preference study of market demand. The reported “black-market” prices have not been verified through primary contracts and therefore cannot be presented as the average prices of actual completed transactions. These limitations provide the rationale for conducting a pilot auction and progressively updating the underlying data.

Proposed package of legal and legislative amendments

Implementation of the proposed market-based model cannot be limited to an administrative decision or the organization of a single auction. The existing legal framework recognizes the possibility of selling fertile soil removed as a result of construction activities; however, its principal mechanisms are structured around individual transactions, a price agreed between the owner and the buyer, and subsequent reporting requirements. In the case of the historical, large-scale stockpile adjacent to the Akhuryan Reservoir, a specific legal framework is required to bridge the entire process—from identification of origin and ownership to inventory, valuation, public sale, earmarked allocation of revenues, and control over final use.

The logic of legal reform should respect the hierarchy of legal norms. The ownership regime, entitlement to public revenues, the fundamental requirement for mandatory auctioning, and the essential elements of liability should be established by law. Measurement methodology, quality classification, calculation of the starting price, operation of the electronic platform, and contractual monitoring may be detailed through government decisions. Within the community, the selection of annual earmarked programs may be made by a decision of the Council of Elders, but only within the framework previously established by law and government regulations.

The legal roadmap presented below distinguishes the substantive objective of each reform, the legal act to be amended, and the required level of legal intervention. This

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distinction is also important for ensuring legal certainty: a subordinate legal act cannot alter the allocation of budget revenues established by law or create new administrative liability, whereas amending a law merely to establish a technical measurement protocol would constitute an unnecessarily burdensome intervention.

Table 8**Systematic Roadmap of Proposed Legal and Legislative Amendments**

Reform Area	Legal Act to Be Amended or Adopted	Proposed Legal Solution	Level and Responsible Authority
1. Legal status and ownership of the stockpile	Supplement to Article 36 of the RA Land Code and, if necessary, a special transitional provision; RA Government Decision No. 1396-N	Define the concepts of “removed fertile soil layer,” “historically accumulated stockpile,” and “large-scale public stockpile.” Require a legal audit of origin, ownership, balance-sheet attribution, and third-party rights prior to sale. Establish a one-time inventory and state/community registration procedure for the Akhuryan stockpile.	Amendment to the Land Code — National Assembly. Implementing procedure — RA Government, Ministry of Environment, Ministry of Territorial Administration and Infrastructure, Cadastre Committee, and community.
2. Mandatory certification of volume, quality, and suitability	Amendments to RA Government Decisions No. 1396-N and No. 124-N, together with a new methodological annex	Require 3D geodetic surveying, stratified sampling, accredited laboratory testing, and an A/B/C/X quality passport. For each lot, disclose volume, moisture content, organic matter, contamination indicators, and permitted end uses. Exclude Class X from market sale until remediation.	Government decision, without legislative amendment where the ownership regime is clear. Methodology — Ministry of Environment, with participation of the Ministry of Economy and the National Accreditation Body.
3. Independent valuation and starting price	Revision of Paragraph 4 of RA Government Decision No. 676-N or a separate annex on “Valuation and Starting-Price Methodology”; harmonization with the Law on Valuation Activity	For large state- and community-owned stockpiles, replace mutually agreed pricing with independent valuation and a reserve price. Separate the price into ex-stock value, loading, transportation, and tax components. Apply a reference formula based on a quality coefficient, the median of legally comparable transactions, restoration value, and sales costs. Revaluation at least every 90 days or following a material market change.	Government decision. Independent appraiser selected competitively. Valuation report and underlying data disclosed in a public data room.
4. Mandatory electronic auction and the exceptional role of competitive selection	Supplement to RA Government Decision No. 676-N and a special auction procedure based on the Law on Public Auctions; if necessary, amendment concerning specific natural-resource lots	State/community lots exceeding 1,000 m ³ or a monetary threshold established by the Government should be sold through an open electronic ascending-price auction. Competitive selection should be permitted only for allocating the public land-restoration reserve where the winner is determined not solely by price but also by	Government decision for the procedure. Targeted legislative amendment by the National Assembly if mandatory auction requirements or exceptions conflict with existing law. Platform operator — authorized body or competitively selected operator.

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		measurable environmental outcomes. Establish a 5% bid security, a 2–5% bid increment, disclosure of related parties, a volume cap per buyer, and rules for repeated auctions.	
5. Public land-restoration reserve and limits on free allocation	Supplement to Article 36 of the RA Land Code; amendments to Decisions No. 676-N and No. 1396-N; harmonization with the Law on Local Self-Government	Allow 15–25% of the stockpile to be reserved exclusively for approved restoration projects. Free or preferential allocation should be conducted through a public competitive procedure based on quantitative land-improvement indicators, beneficiary co-financing, and time-bound obligations. Establish a resale prohibition, electronic proof of intended use, and repayment of market value in case of non-compliance (clawback).	Fundamental rights and restrictions — by law. Criteria and contractual terms — by government decision. Project selection — by a public decision of the Council of Elders.
6. Revenue ownership and earmarked use — conservative option	Clarification of Paragraph 5 of Decision No. 676-N; amendments to the laws on the RA Budgetary System and Local Self-Government; relevant budget-classification regulation	Preserve the existing principle that 100% of gross proceeds from the sale of stock originating from state or community land is transferred to the community budget. After verified direct costs, earmark at least 50% of net revenue for land restoration, irrigation, erosion prevention, and green infrastructure. Give priority to the settlement directly affected by the stockpile. Establish a separate treasury sub-account and performance indicators.	Legislative amendments to protect earmarked revenue on a multi-year basis. Annual programs — Council of Elders. Reporting — open-budget format.
7. Revenue allocation — 70/20/5/5 reform option	RA Land Code; Law on the RA Budgetary System; Paragraph 5 of Decision No. 676-N; annual State Budget Law and budget classification	Allocate net revenue as follows: 70% community; 20% national targeted land-restoration program; 5% competitive environmental window for communities of Shirak Region; and up to 5% for actual surveying, auction, and monitoring costs. The “regional 5%” should not be treated as freely disposable revenue of the regional administration, but as a state-budget program allocation distributed through regional competition.	Mandatory legislative package and annual budget implementation. Adoption — National Assembly; implementation — Ministry of Finance, Ministry of Environment, Ministry of Territorial Administration and Infrastructure, and communities.
8. Organizer remuneration and prevention of conflicts of interest	Implementing regulations under the Law on Procurement; supplement to Decision No. 676-N; standard auction-operator contract	Select the private organizer through competitive procurement. Set remuneration as a fixed amount or at no more than 2% of additional net revenue, without assigning any share of gross sales revenue. Require disclosure of beneficial	Government decision and contractual regulation. Legislative amendment only if a special exception to general procurement rules is created, which is not recommended.

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		ownership, related parties, and conflicts of interest. Where possible, separate measurement, valuation, and auction-organization functions.	
9. Digital traceability and oversight	Amendments to Decisions No. 676-N and No. 1396-N; targeted amendments to environmental-control legislation and the statute of the inspection authority	Establish a unified digital stockpile register with a unique lot code, electronic dispatch document, weight/volume data, transportation route, and confirmation of final placement. Provide the supervisory authority with direct data access and powers for on-site inspection, transaction suspension, and post-sale verification of intended use. Publish contracts, winners, prices, and implementation status, except for legally protected information.	Digital procedure — government decision. New supervisory powers — by law where they restrict rights or constitute a basis for enforcement. Operator — authorized state body.
10. Liability, compensation, and recovery	Amendment to Article 54.2 of the RA Code of Administrative Offences; contractual annex to Decision No. 676-N; harmonization with existing provisions of the RA Criminal Code in cases of major damage or fraud	Link penalties to the volume unlawfully disposed of or its market value so that violations are not economically profitable. Establish recovery of unlawful proceeds, confiscation of unused soil or in-kind restoration, and separate offences for falsified laboratory documentation, absence of dispatch documentation, resale, and violation of intended-use requirements. Provide stricter liability for public officials and disqualification for repeated violations.	Administrative liability — exclusively by law. Contractual penalties and recovery of market value — through a standard contract approved by the Government.
11. Tax and accounting certainty	RA Tax Code only where necessary; otherwise, official clarification by the State Revenue Committee/Ministry of Finance and practical accounting guidance	Clarify whether the sale price is quoted including or excluding VAT, who is considered the supplier, which document formalizes the sale of state/community property, and how the organizer's services are taxed. No tax exemption should be introduced without a cost-benefit analysis; preferential supply for land restoration should preferably be addressed through a budget subsidy rather than a hidden tax exemption.	Initially — official clarification and standardized accounting treatment. Tax Code amendment only where a clear legal gap exists. Responsible authorities — Ministry of Finance and State Revenue Committee.

Source: Authors' elaboration based on a systematic analysis of the existing legal acts of the Republic of Armenia.

As follows from Table 8, most of the proposed measures can be implemented in stages, without waiting for the adoption of the entire legislative package. At the first stage, within the existing legal framework, the community may complete the ownership audit,

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conduct independent surveying and laboratory assessment, select the organizer through a procurement procedure, and design the public auction in accordance with the general principles of the Law on Public Auctions. At this stage, the allocation of sales proceeds should remain consistent with the existing logic of Decision No. 676-N, and no interbudgetary redistribution may be introduced solely through a contract or a decision of the Council of Elders.

At the second stage, within 3–6 months, it would be advisable to amend Decisions No. 676-N and No. 1396-N through a single integrated government decision and approve unified annexes governing the quality passport, valuation, lotting, electronic auction, digital dispatch documentation, and oversight. Amendments to Decision No. 124-N should be limited to the technical linkage between contamination testing and restrictions on the circulation of Class X material, without duplicating general environmental regulations.

At the third stage, within 6–12 months, an integrated rather than fragmented legislative package should be submitted to the National Assembly, including amendments to the Land Code, the Law on the Budgetary System of the Republic of Armenia, the Law on Local Self-Government, and the Code of Administrative Offences. If the 70/20/5/5 allocation model is selected, the same package should also establish the interbudgetary transfer formula, treasury sub-accounts, eligible expenditure categories, performance auditing, and procedures for the return of unused funds. Otherwise, the proposed allocation percentages would remain merely a policy declaration without a legal basis for actual payments.

For the Akhuryan stockpile, the initial solution involving the lowest legal risk is the conservative option: transfer all sales proceeds to the community budget, ensure transparent reimbursement of actual costs, and provide legally protected reinvestment of at least half of the net revenue in natural capital. The 70/20/5/5 model may be introduced from the second auction stage or following implementation of a nationwide framework, once the national targeted program, regional competitive funding window, and digital accountability system are operational. This sequencing makes it possible to bring the stockpile to market without compromising the principles of legality of public revenues, community autonomy, and budgetary integrity.

Selection of operators for organizing lot sales and the tripartite revenue-sharing model

Under the proposed structure, a private or public operator is selected for each lot to organize the sale of the soil, including advertising, buyer outreach, documentation, loading, and record-keeping. This approach may improve the speed and professional quality of sales, but only if the operator is legally separate from the final buyer. If the successful bidder for a lot is simultaneously granted the right to resell the soil in its own name and determine the final price, the public authority will lose the incremental value generated through auction-based price discovery, while the 15% profit-margin cap will be difficult to enforce in practice.

A two-stage structure is therefore proposed. In the first competitive procedure, an operator providing sales-management services is selected; in the second stage, the final buyers of the soil are selected through separate electronic auctions. The owner of the stockpile, or the public authority legally authorized to act on its behalf, remains the seller. Buyers make payments directly into a Treasury transit account, while the operator does not receive the

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entire sales revenue and subsequently redistribute it. This structure reduces the risks associated with holding public funds, underreporting volumes, and related-party transactions.

The illustrative payments of AMD 5,000 to the State and AMD 2,000 to the community should be treated not as fixed policy figures but as minimum public obligations established per cubic metre. Under Paragraph 5 of the existing Decision No. 676-N, proceeds from the sale of fertile soil originating from state- and community-owned land are transferred to the community budget. Therefore, directing AMD 5000/m³ to the State Budget would first require amendments to the Land Code, budgetary legislation, and Decision No. 676-N; neither a contract nor a competitive tender notice alone can create a new revenue entitlement for the State Budget.

Let q_i - denote the volume actually sold from lot l and verified by independent measurement; $g_s=5000$ AMD/m³ the statutory payment to the State Budget; $g_c=2000$ AMD/m³ the payment to the community; c_i - the allowable organizational cost per cubic metre proposed by b_i ; and $r=0.15$ - the permitted profit margin on that cost. The minimum amount payable to the public budgets is therefore:

$$R_l^{\text{pub}} = (g_s + g_c)q_l = 7000q_l \quad (8)$$

The operator's remuneration should be calculated on the basis of the **verified cost base**, rather than as 15% of the total sales revenue. Otherwise, when the sale price is high, private earnings would increase without a corresponding increase in the amount of work performed, while at a low sale price the actual costs could be obscured. The operator's fee per cubic metre and the profit component included therein are calculated, respectively, as follows:

$$f_i = (1 + r)c_i = 1.15c_i \quad (9)$$

$$\pi_i = rc_i q_l = 0.15c_i q_l \quad (10)$$

Here, c_i - should include only those costs explicitly permitted in advance by the tender documentation, including publication, use of the electronic platform, supervision of measurements, documentation, loading, and other activities assigned to the operator under the contract. The acquisition cost of the soil, penalties, payments to related parties, and unjustified administrative mark-ups should **not** be included in the eligible cost base.

The minimum payable price for the final buyer, excluding separately calculated transportation and tax components, will therefore be:

$$p_l^{\text{min}} = g_s + g_c + (1 + r)c_i + \tau_l \quad (11)$$

where τ_l - represents the tax or mandatory transaction-related component borne by the seller. If transportation is paid by the buyer directly to the carrier, it should not be included in the auction price of the soil; otherwise, differences in transportation distances would make lot prices incomparable.

Moreover, if the estimated upper price supported by legal market demand is below p_l^{min} , the lot should not be sold merely as a formality or by reducing the established public obligations. Instead, the lot structure, eligible costs, or the AMD 5,000/2,000 statutory payment parameters should be reconsidered.

The alternative methods of selecting the operator do not produce the same economic outcome. The following table compares three institutional structures, taking into account the

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protection of public revenue, the nature of competition, and the enforceability of the 15% profit-margin cap.

Table 9

**Comparative Assessment of Alternative Models
for Selecting the Operator for the Sale of Fertile Soil**

Selection Model	Winner Selection Criterion	Advantages and Risks	Assessment
A. Two-Stage Service Tender (Proposed)	Among participants meeting the minimum technical threshold, the bidder offering the lowest c_{i_i} or the lowest f_{i_i} wins. Final buyers are selected through a separate auction.	The public authority retains ownership and captures the entire incremental value generated through price discovery. The 15% profit margin is measurable and enforceable. Requires a clearly defined cost audit and two separate procedures.	Most appropriate for a large-scale, multi-lot stockpile.
B. Guaranteed Public Payment Tender	The qualified bidder offering the highest guaranteed public payment above AMD 7,000/m ³ and accepting the 15% cost-based profit-margin cap wins.	Public revenue may increase, but comparison of bids becomes more complex where bidders have different cost bases. Performance security should be required.	Applicable to pilot lots as an additional selection criterion.
C. Full Transfer of the Lot to a Reseller	The dealer offering the highest upfront payment for the lot wins and subsequently resells the material at its own risk.	Simple and fast, but the 15% profit margin can no longer be effectively controlled, while subsequent price appreciation accrues to the dealer. There is a significant risk of related-party transactions.	Not recommended where the objective is to preserve incremental price gains for the public sector.

Source: Authors' proposal based on the separation of competitive procurement and public sale procedures.

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The comparison demonstrates that the concept of a “lot winner” should be divided into two distinct roles in the legal documentation: the operator and the final buyer. The operator selection procedure constitutes the procurement of a service and should be conducted within the framework of the Law on Procurement, whereas selection of the final buyer constitutes the disposal of property and should be organized in accordance with the Law on Public Auctions and the relevant special procedure. A public-private partnership structure would be justified only where the contract is long-term, involves substantial private investment, and provides for risk sharing. Treating an ordinary sales operator for one or several lots as a project would unnecessarily complicate the procedure.

Under the proposed tender procedure, a qualification stage is applied first, requiring at least three years of relevant experience, tax compliance, disclosure of beneficial owners, adequate technical capacity, 10% performance security, and independence from final buyers. Among the qualified participants, the winner is then selected through reverse price competition, as follows:

$$i^* = \arg \min_{i \in Q} c_i \quad (12)$$

where Q denotes the set of participants that satisfy all qualification and conflict-of-interest requirements. An abnormally low bid should be subject to justification; if c_i does not cover the estimated cost of the mandatory activities, the bid should be rejected as unrealistic.

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At the same time, it is advisable that no single operator be awarded more than 25–30% of the total stockpile, provided that a sufficient number of qualified participants is available. This limit prevents an organizational monopoly and generates comparable performance data across operators.

The practical feasibility of the AMD 5,000/2,000 statutory payment parameters depends on the organizational cost per cubic metre. In the following scenario analysis, taxes and transportation are treated separately, while the operator's 15% profit margin is calculated on the basis of the eligible cost c_i .

Table 10

Impact of the Operator's Allowable Cost and 15% Profit Margin on the Minimum Sale Price

c_i AMD/m ³	Operator Fee: $1.15c_i$	Included Profit: $0.15c_i$	Minimum Sale Price, AMD/m ³	Price Feasibility within the AMD 4,000–8,000 Range
500	575	75	7,575	Feasible
800	920	120	7,920	Borderline
1,000	1,150	150	8,150	Above the upper market threshold
1,500	1,725	225	8,725	Above the upper market threshold

Source: Author's calculations. Note: Transportation and taxes are calculated separately.

The calculation reveals an important limitation of the proposed figures. If the operator's allowable cost is AMD 1,000/m³, the minimum sale price already reaches AMD 8,150/m³, even before transportation and any applicable tax additions. This exceeds the stated upper limit of the informal market range of AMD 8,000/m³. Therefore, the AMD 5,000 and AMD 2,000 payments cannot be applied mechanically to all quality classes and all lots. They should either be established as indexed reserve payments differentiated by quality and location, or be incorporated within an overall minimum public payment of AMD 7,000/m³, excluding the operator's fee where that fee is financed from another budgetary source.

If the average actual price achieved at the final auction exceeds the minimum price, allowing the operator to retain the entire increment would contradict the logic of the 15% profitability cap. The additional public revenue generated by lot l is calculated as:

$$S_l = \max\{0, [\bar{p}_l - g_s - g_c - (1+r)c_i - \tau_l]q_l\} \quad (13)$$

It is proposed that 70% of S_l be allocated additionally to the community and 30% to a targeted national land-restoration program. The operator may receive only a limited performance bonus—for example, no more than 3% of the incremental amount—but this bonus should be included within the overall 15% profitability ceiling rather than added on top of it. In this way, the private operator is incentivized to increase legitimate demand without appropriating the market rent generated by the public resource.

The payment system should operate according to the principle of «no funds passing through the operator's account». The buyer makes a single payment into a Treasury transit account, specifying the unique lot code. No payment or profit is calculated for unsold volume. In the event of delay in performance, the operator's payment is reduced; in cases of volume falsification or preferential treatment of a related buyer, contractual termination, forfeiture of performance security, and temporary exclusion from participation in tenders should apply.

For legal implementation, Decision No. 676-N should be supplemented with the concepts of «sales operator», «final buyer», «minimum public payment», «allowable cost», and «Treasury transit account», together with two separate standard-form contracts. The Law

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on the Budgetary System of the Republic of Armenia and the Land Code should establish the allocation of the State and community statutory payments and the distribution of incremental revenue. The operator-selection notice and contract should be approved under procurement legislation, whereas the rules governing the auction for final sale should be established under the Law on Public Auctions. Amendment of the Tax Code is not necessarily required if the Ministry of Finance and the State Revenue Committee jointly clarify, through a unified procedure, the treatment of VAT, invoicing, and taxation of the operator's services¹.

Limitation on the number and volume of lots per participant

In a multi-lot tender, one of the most direct instruments for preventing concentration is to impose a quantitative limit on the number of lots in which a single participant may participate or win. For example, each participant may be permitted to submit a bid for only one lot or, under a more flexible approach, to bid for several lots but win no more than one or two. This rule prevents a single technically or financially stronger company from gaining control over the sale of the entire stockpile.

However, the «maximum number of bids» and the «maximum number of lots awarded» are not equivalent concepts. If a participant is allowed to bid for only one lot, it must anticipate at the selection stage which lot is likely to attract less competition. As a result, some attractive lots may receive numerous bids while others receive none. To preserve overall competition, it is more efficient to allow participants to bid, for example, for up to two or three lots, indicating their order of preference, while contractually limiting each participant to winning one lot. Where a large number of lots is offered, the award cap may be increased to **two lots**.

Let x_i equal 1 if participant i wins lot l , and 0 otherwise. Each lot should be assigned to only one operator, while the number of lots awarded to any single participant must not exceed the limit K :

$$\sum_i x_{il} = 1 \quad \forall l, \quad \sum_l x_{il} \leq K_i \quad \forall i, \quad K_i \in \{1, 2\} \quad (14)$$

The quantitative limit should be supplemented by a volume-based restriction, since the lots may differ substantially in size. If a participant wins only one but exceptionally large lot, the $K=1$ rule is formally satisfied, while market concentration may nevertheless remain high. It is therefore advisable to establish an additional requirement that the total volume attributable to a participant and its related parties should not exceed an α share of the total stock offered for sale:

$$\sum_l V_l x_{il} \leq \alpha V^T, \quad \alpha \in [0.20, 0.25] \quad (15)$$

where V_l is the certified volume of lot l , and V^T is the total volume offered during the relevant tender stage. A 20–25% volume cap should be regarded as an initial policy threshold and adjusted according to the number of lots, the actual number of participants, and their

¹ See: RA Land Code — <https://www.arlis.am/hy/acts/224001>; RA Government Decision No. 676-N — <https://www.arlis.am/hy/acts/152162>; Law on the Budgetary System of the Republic of Armenia — <https://www.arlis.am/hy/acts/219259>; Law on Procurement — <https://www.arlis.am/hy/acts/110820>; Law on Public Auctions — <https://www.arlis.am/hy/acts/75480>

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technical capacities. If only three or four large lots are offered, a 20% cap may be impracticable. In such cases, it is preferable to restructure the stockpile into smaller lots rather than mechanically grant an exemption from the concentration limit to a single participant.

The three practical options for limiting participation are presented below. The applicable model should be selected before the tender is announced and applied uniformly to all participants. Any retroactive modification of the limits or an exemption granted to a specific participant would undermine the principle of equal treatment in the tender procedure.

Table 11**Alternative Models for Limiting Bids and Awards in a Multi-Lot Tender**

Model	Bid Submission Limit	Award Limit	Assessment of Applicability
I. Strict Single-Lot Model	A participant selects and submits a bid for only one lot.	Maximum 1 lot and no more than 20–25% of the total volume.	Simple and effective in preventing concentration, but increases the risk of some lots receiving no bids. Suitable for a small pilot stage with comparable lots.
II. Two Bids–One Award (Proposed Pilot Model)	A participant may submit bids for a maximum of 2 lots, indicating first and second preference.	Maximum 1 lot and no more than 20–25% of the total volume.	Maintains competition while preventing concentration. The most balanced option for the first stage of the Akhuryan sales process.
III. Multiple Bids–Two Awards	A participant may submit bids for all lots or for a maximum of 3–4 lots.	Maximum 2 lots, but no more than 20–25% of the total volume.	Applicable where there are numerous small lots and a sufficient number of participants. Requires a simultaneous electronic allocation al

Source: Author's proposal based on the principles of anti-concentration and volume limitation.

Based on the comparison presented in the table, the “two bids–one award” rule is recommended for the first stage of the Akhuryan stockpile sales process. A participant may select a maximum of two lots and must indicate the order of preference in its bid. However, once the participant is declared the winner of one lot, its bid for the other lot is excluded from further allocation. If the participant does not win the lot indicated as its first preference, its bid remains valid for the second-preference lot. In subsequent stages, once the actual number of participants, operating costs, and quality of performance are known, the award limit may be increased to two lots while maintaining the 20–25% volume cap.

The lots should not be allocated through a sequence of independent auctions, but within a single integrated tender window. Otherwise, the winner of the first lot could participate in subsequent auctions before the system confirms that the applicable award limit has been reached, while the sequence in which the auctions are conducted could influence the final allocation. Based on the qualified bids, the system should select the allocation that, while satisfying all applicable constraints, minimizes the total operator remuneration or maximizes the net public benefit.

If several permissible allocations produce the same result, preference should first be given to the allocation involving a larger number of independent operators, followed by the allocation with the higher technical quality score. Only as a final tie-breaking mechanism should a pre-disclosed randomization procedure or the earliest-bid rule be applied. This hierarchy should be explicitly established in the tender documentation, thereby eliminating subsequent discretionary selection by the evaluation committee.

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The limitation should apply not only to an individual legal entity but to the economic group as a whole. Entities with the same beneficial owner, controlled or affiliated entities, members of a consortium, and sole proprietors controlled by them should be treated as a single participant for the purposes of the lot-award limits. A declaration of beneficial ownership should be required at the bid-submission stage. In the event of false or incomplete disclosure, all affiliated bids should be rejected, the performance security forfeited, and a temporary prohibition on participation imposed. Transfer of an awarded contract, ownership interest, or operator rights should be permitted only with the prior approval of the authorized body and should not be used to circumvent the applicable limits.

For lots that remain unsold or fail to attract a sufficient number of bids, any exception should be introduced gradually. A repeat tender should first be conducted with a revised timeframe or lot size. Only thereafter may a participant that has already won one lot be permitted to receive a second lot, provided that the 25% volume cap is not exceeded. Any such exception should be formally recorded and published on the electronic platform, together with the justification demonstrating the lack of sufficient competition.

From a legal perspective, Decision No. 676-N and the special procedure governing operator selection should explicitly establish the maximum number of bids and awarded lots, the volume cap, the aggregation of related parties for purposes of calculating the limit, the procedure for indicating lot preferences, and the phased exception procedure for unsuccessful lots. The tender notice should disclose the volumes and quality classes of all lots, applicable limits, and the allocation algorithm. Establishing these requirements through a subordinate legal act is sufficient, provided that the legal basis for mandatory competitive selection and the competence of the authorized body have already been established by law².

In summary, the proposed model is viable under three conditions: first, the AMD 5,000 and AMD 2,000 payment rates are supported by an independent valuation and periodically reviewed; second, the 15% margin is applied to auditable eligible costs rather than to sales revenue; and third, the competitive procedures for selecting the operator and the final buyer are legally and technically separated. In the absence of these conditions, the system may effectively become a private resale concession in exchange for a fixed public payment, in which case the State and the community would lose the incremental value generated by the market price.

Conclusions and recommendations

Based on the results obtained, the following main conclusions and recommendations are formulated.

From the perspective of economic efficiency, the separation of the final buyer from the operator organizing the sale is essential. The operator should be selected through competitive procurement of services and remunerated on the basis of controlled eligible costs, while the final buyers of the soil should be selected through a separate electronic auction. This structure preserves the incremental value generated through public price discovery and reduces the

² Legal basis for separating the procedures for selecting the operator and the final buyer: Law of the Republic of Armenia on Procurement; Law of the Republic of Armenia on Public Auctions; RA Government Decision No. 676-N.

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risks of revenue underreporting, related-party transactions, and uncontrolled private resale rents.

The existing legal framework provides, in principle, for the sale of fertile soil removed as a result of construction activities, but it does not fully address the inventory, lotting, mandatory auctioning, concentration of participants, and earmarked reinvestment of revenues associated with large historical stockpiles. The proposed model therefore operates on two horizons: an immediately applicable pilot auction under the existing legal framework, followed by a package of legislative and subordinate regulatory reforms.

The results of the study demonstrate that management of the fertile soil stockpile accumulated in the vicinity of the Akhuryan Reservoir is simultaneously a legal, environmental, and public-finance issue. The economic value of the stockpile is significant; however, it cannot be determined solely on the basis of offers circulating in the informal market. A legally defensible price should be established only after verification of ownership and origin, independent measurement, stratified laboratory testing, quality classification, and competitive price discovery.

1. The 212,532 m³ Akhuryan stockpile represents an economically valuable, long-stored historical topsoil resource rather than an automatically homogeneous commercial «chernozem».
2. Where its construction-related origin is properly documented, its sale is permissible within the framework of Article 36 of the RA Land Code and Decision No. 676-N.
3. Free administrative distribution of the entire stockpile is not advisable. Such allocation should be limited to a defined public restoration reserve and implemented through an open, outcome-based selection procedure.
4. The principal mechanism for commercial lots should be an open electronic auction. Competitive selection should be used where the award criterion also includes measurable environmental outcomes.
5. The informal price range of AMD 4,000–8,000/m³ indicates the existence of demand but does not constitute a sufficient legal or valuation basis for establishing the starting price. It should be adjusted using legally verifiable comparables, quality, location, and the services included in the quoted price.
6. A pilot starting-price range of AMD 3,500–4,500/m³ may be applied only after independent valuation, on an ex-stockpile basis, with appropriate premiums or discounts according to quality class.
7. Under the AMD 4,000–8,000/m³ scenarios, the theoretical gross value of the stockpile amounts to approximately AMD 850.1 million–1.700 billion. However, phased sales and the public reserve will reduce the volume actually offered for sale while helping protect market prices.
8. Under the existing legal framework, 100% of gross sales proceeds should be transferred to the community budget. Any direct percentage allocation to the State, regional level, or organizer requires appropriate legal amendments.
9. The organizer should be selected through competitive procurement and remunerated through an actual-cost-based or performance-based service fee rather than an unrestricted share of the resource rent.

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10. The preferred immediately applicable model consists of a 15–25% public restoration reserve, 75–85% phased auction-based sale, and allocation of at least 50% of net community revenue to land restoration, irrigation, and green infrastructure.
11. A national digital soil exchange/database should be established to integrate stock availability, quality, supply, demand, dispatch documentation, and final use within a unified traceability system.
12. Legislative reform should supplement Decision No. 676-N with mandatory auction requirements for large public stockpiles, minimum valuation standards, quality classification, earmarked revenue reporting, and transitional rules for historical stockpiles.

Thus, the proposed system does not amount to the simple commercialization of fertile soil. Rather, it uses the market as an instrument for demand and price discovery, while preserving the public character of natural capital, community interests, and post-sale control over intended use.

Under the conservative budget-management option, sales proceeds remain within the community budget, with at least half of net revenue earmarked for land restoration, irrigation, erosion prevention, and green infrastructure. A model based on fixed State, community, and organizational shares may be introduced only after the necessary legislative amendments. Moreover, the operator's 15% profit margin should be calculated exclusively on documented eligible costs, not on gross sales revenue.

The recommendations follow a unified sequence: the public authority first establishes the legal and quality passport of the stockpile, then divides it into homogeneous and economically accessible lots, defines the public restoration reserve, and places only the remaining volume on the market. During the first competitive stage, the “two bids—one award” rule should be applied, together with an aggregate 20–25% volume cap per economic group. This restriction should also apply to entities under the same beneficial ownership and to related parties.

During the pilot stage of a multi-lot tender, each participant may submit bids for a maximum of two lots, but may win only one lot, without exceeding 20–25% of the total volume offered.

The operator's 15% profitability margin should be calculated solely on the basis of eligible costs identified through competition and subject to audit, while any incremental value generated by the auction price should remain with the public budgets.

Practical roadmap

The implementation of the proposed recommendations should be divided into successive stages of legal preparation, pilot sales, and phased scaling-up. The proposed timeline and responsible authorities are presented below.

The logic of the roadmap is that the sale of the entire stockpile should not commence before the results of the pilot stage have been evaluated. This approach makes it possible to refine the pricing, lot structure, and size of the public restoration reserve.

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Phased Roadmap for the Implementation of the Proposed Recommendations

Timeline	Action	Responsible Party	Expected Outcome
0–3 months	Legal audit, 3D inventory, additional sampling	Ani Community + authorized body + independent experts	Legal and quality passports
3–6 months	Valuation, public restoration reserve program, auction regulations	Council of Elders and Head of the Community	Approved lotting structure and prices
6–12 months	Pilot auctions of 5,000–10,000 m ³	Competitively selected organizer	Actual market price discovery and testing of the sales process
1–3 years	Phased sale of 30,000–40,000 m ³ annually	Community and supervisory authority	Managed market circulation
3–7 years	Optimization of the remaining stock and audit of restoration outcomes	Community / State	Targeted completion of stockpile management and restored lands

Source: Author's proposal.

The current versions of the relevant legal acts were verified through the Armenian Legal Information System as of 24 August 2026. The baseline data and assumptions used in the pricing scenarios should be revalidated immediately prior to publication, accompanied by the laboratory test reports, digital lot passports, and an anonymized database of pilot-auction results.

References

1. FAO. (2015). Status of the World's Soil Resources: Main Report. Rome: FAO; IPBES. (2018). The IPBES Assessment Report on Land Degradation and Restoration. Bonn: IPBES; UNCCD. (2022). Global Land Outlook (2nd ed.). Bonn: UNCCD; European Commission. (2021). EU Soil Strategy for 2030. COM(2021) 699 final.
2. Rugani, B., & Petucco, C. (2025). Environmental benefits of re-using excavated soil flows: The case of Luxembourg. *Science of the Total Environment*, 958, 177867. <https://doi.org/10.1016/j.scitotenv.2024.177867>
3. D'Agui, H. M., van der Heyde, M. E., Nevill, P. G., et al. (2022). Evaluating biological properties of topsoil for post-mining ecological restoration: Different assessment methods give different results. *Restoration Ecology*, 30(S1), e13738. <https://doi.org/10.1111/rec.13738>
4. Amir, H., Bordez, L., Cavaloc, Y., Jourand, P., Ducousso, M., & Juillot, F. (2022). Effects of ultramafic topsoil stockpiling during mine activities on its microbial diversity and other microbiological and physicochemical characteristics. *Ecological Engineering*, 177, 106563. <https://doi.org/10.1016/j.ecoleng.2022.106563>
5. Fischer, A., Singh, J. P., Van Hamme, J., Bottos, E., & Fraser, L. H. (2025). Investigating impacts from topsoil stockpile height on soil microbial communities. *Frontiers in Microbiomes*, 4, 1607677. DOI; Ledesma, J., et al. (2025). Effects of stockpiling on topsoil biogeochemistry for semiarid mine reclamation. *Mining, Metallurgy & Exploration*, 42, 15–26. <https://doi.org/10.3389/frmbi.2025.1607677>
6. Ledesma, J., et al. (2025). Effects of stockpiling on topsoil biogeochemistry for semiarid mine reclamation. *Mining, Metallurgy & Exploration*, 42, 15–26. <https://doi.org/10.1007/s42461-024-01164-2>

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7. Valliere, J. M., D'Agui, H. M., Dixon, K. W., et al. (2022). Stockpiling disrupts the biological integrity of topsoil for ecological restoration. *Plant and Soil*, 471, 409–426. <https://doi.org/10.1007/s11104-021-05217-z>
8. City of Helsinki. (n.d.). Supporting the reuse of excavated soil in construction projects. European Circular Economy Stakeholder Platform. <https://circulareconomy.europa.eu/platform/en/good-practices/city-helsinki-supporting-reuse-excavated-soil-construction-projects>
9. Cristóbal, J., Foster, G., Caro, D., et al. (2024). Management of excavated soil and dredging spoil waste from construction and demolition within the EU: Practices, impacts and perspectives. European Commission, Joint Research Centre. <https://publications.jrc.ec.europa.eu/repository/handle/JRC138483>
10. NSW Resources Regulator. (2021). Materials and Soil Management to Support the Post-Mining Land Use: Consolidated Audit Report. New South Wales Government.
11. Department for Environment, Food & Rural Affairs. (2009). Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (PB13298). London: DEFRA.
12. Block, P. R., Gasch, C. K., & Limb, R. F. (2020). Biological integrity of mixed-grass prairie topsoils subjected to long-term stockpiling. *Applied Soil Ecology*, 145, 103347. <https://doi.org/10.1016/j.apsoil.2019.08.009>
13. Hale, S. E., Roque, A. J., Okkenhaug, G., et al. (2021). The reuse of excavated soils from construction and demolition projects: Limitations and possibilities. *Sustainability*, 13(11), 6083. <https://doi.org/10.3390/su13116083>
14. Samarasinghe, O., & Greenhalgh, S. (2013). Valuing the soil natural capital: A New Zealand case study. *Soil Research*, 51(4), 278–287. <https://doi.org/10.1071/SR12246>
15. Meissner, L., & Musshoff, O. (2022). Revisiting the relationship between farmland prices and soil quality. *Q Open*, 2(2), qoac017. <https://doi.org/10.1093/qopen/qoac017>
16. Sen Chakraborty, K., Chakraborty, A., & Berrens, R. P. (2023). Valuing soil erosion control investments in Nigerian agricultural lands: A hedonic pricing model. *World Development*, 170, 106313. <https://doi.org/10.1016/j.worlddev.2023.106313>
17. Koutroumpis, P., & Cave, M. (2018). Auction design and auction outcomes. *Journal of Regulatory Economics*, 53, 275–297. <https://doi.org/10.1007/s11149-018-9358-x>
18. Coviello, D., & Mariniello, M. (2014). Publicity requirements in public procurement: Evidence from a regression discontinuity design. *Journal of Public Economics*, 109, 76–100. <https://doi.org/10.1016/j.jpubeco.2013.10.008>
19. Klemperer, P. (2002). What really matters in auction design. *Journal of Economic Perspectives*, 16(1), 169–189. <https://doi.org/10.1257/0895330027166>
20. Rosen, S. (1974). Hedonic prices and implicit markets: Product differentiation in pure competition. *Journal of Political Economy*, 82(1), 34–55. <https://doi.org/10.1086/260169>
21. Government of the Republic of Armenia. (2021). Decision No. 676-N of 29 April 2021 «On Establishing the Procedure for the Sale of Fertile Topsoil Removed as a Result of Construction Works». <https://www.arlis.am/hy/acts/152162>
22. Land Code of the Republic of Armenia, Article 36, current consolidated version. <https://www.arlis.am/hy/acts/224001>

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23. Law of the Republic of Armenia “On Public Auctions,” Article 2 — Definitions of Auction and Competitive Tender. <https://www.arlis.am/hy/acts/75480>
24. European Commission. (2020). *A New Circular Economy Action Plan: For a Cleaner and More Competitive Europe*. COM(2020) 98 final.
25. European Environment Agency. (2020). *Soil and Land in Europe: State and Pressures*. Luxembourg: Publications Office of the European Union. European Environment Agency
26. ISO. (2015). *ISO 11074:2015 Soil Quality—Vocabulary*. Geneva: International Organization for Standardization.
27. ISO. (2018–2022). *ISO 18400 Series: Soil Quality—Sampling*. Geneva: International Organization for Standardization.
28. OECD. (2019). *Making Decentralisation Work: A Handbook for Policy-Makers*. Paris: OECD Publishing.
29. TEEB. (2010). *The Economics of Ecosystems and Biodiversity: Ecological and Economic Foundations*. London: Earthscan.
30. World Bank. (2021). *The Changing Wealth of Nations 2021: Managing Assets for the Future*. Washington, DC: World Bank.
31. Republic of Armenia. (1997). *Law of the Republic of Armenia “On the Budgetary System of the Republic of Armenia,” HO-137, 24 June 1997*.
32. Republic of Armenia. (2016). *Law of the Republic of Armenia “On Procurement,” HO-21-N, 16 December 2016*.
33. Republic of Armenia. (2002). *Law of the Republic of Armenia “On Local Self-Government,” HO-337, 7 May 2002, current consolidated version*.
34. Republic of Armenia. (2019). *Law of the Republic of Armenia “On Public-Private Partnership,” HO-113-N, 28 June 2019*.
35. Government of the Republic of Armenia. (2011). *Decision No. 1396-N of 8 September 2011 on the Procedure for the Use of Fertile Topsoil*.
36. Government of the Republic of Armenia. (2018). *Decision No. 124-N of 8 February 2018 on Requirements for the Protection of Soil from Pollution and the Procedure for Assessing Soil Contamination*.
37. Republic of Armenia. *Code of Administrative Offences, Article 54.2, current consolidated version*.
38. Environmental Protection and Mining Inspection Body of the Republic of Armenia. (2022). *Order No. 127-A of the Head of the Inspection Body of 20 September 2022 on the Procedure for Soil Sampling* (official departmental source).

Primary Research Document

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APPENDIX. DRAFT KEY TERMS AND CONDITIONS OF THE AUCTION

The terms and conditions presented in this Appendix may serve as the basis for preparing the auction regulations and the technical specifications for the sale and purchase agreement. They are subject to legal review by the competent authority.

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Table 13

Draft Provisions of the Key Terms and Conditions of the Public Auction

Condition	Proposed Provision
Seller	The legal owner confirmed through an ownership audit, acting pursuant to a decision of the competent community authority
Subject of sale	A lot identified by a unique code, quality class, certified volume, and laboratory passport
Price	AMD/m ³ , ex-stockpile, with VAT status explicitly specified
Participation	Open to eligible natural and legal persons, subject to submission of a conflict-of-interest declaration
Bid security	5% of the starting value of the lot
Auction increment	2–5% of the starting price
Payment	100% prior to loading, or phased payment secured by a bank guarantee
Transportation	At the buyer's expense, with a digital waybill and volume/weight control
Intended use	Only for uses compatible with the lot's quality class; resale restrictions apply to subsidized lots
Liability	Penalties for unused or improperly used volumes, compensation for damages, and restrictions on participation in subsequent procedures
Reporting and transparency	Contract, payment, dispatch, destination, and acceptance certificate recorded in an open database

Source: Author's elaboration. The proposed provisions are subject to legal review by the competent authority.

Upon final approval of the draft, the agreement should explicitly incorporate the lot quality passport, the digital traceability of payment and transportation, evidence of intended use, and the applicable liability measures in the event of non-compliance.

**ԱՆՈՒՐՅԱՆԻ ԶՐԱՄՔԱՐԻ ԹԱՍԻՑ ԿՈՒՏԱԿՎԱԾ ՀՈՂԻ ԲԵՐՐԻ ՇԵՐՏԻ
ՇՈՒԿԱՅԱԿԱՆ ԿԱՌԱՎԱՐՈՒՄԸ. ԳՆԱՀԱՏՄԱՆ, ԼՈՏԱՎՈՐՄԱՆ, ՀՐԱՊԱՐԱԿԱՅԻՆ
ԻՐԱՅՄԱՆ, ԵԿԱՄՈՒՏՆԵՐԻ ԲԱՇԽՄԱՆ և ԻՐԱՎԱԿԱՆ ԲԱՐԵՓՈՒՆՈՒՄՆԵՐԻ
ՀԱՄԱԿԱՐԳԱՅԻՆ ՄՈՂԵԼԸ**

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Հողվածում բերվում է Ախուրյան ջրամբարի շրջակայքում շուրջ չորս տասնամյակ պահեստավորված 212,532 մ³ հողաբուսական շերտի իրավական և տնտեսական շրջանառության գիտագործնական մոդելը: Դաշտային չափագրումների և 2026 թ. լաբորատոր ուսումնասիրության համաձայն՝ պաշարի հումուսի միջին պարունակությունը 3.54% է, մինչդեռ ֆոնային հողի ցուցանիշը 4.54% է: Այդ փաստը հաստատում է ռեսուրսային բարձր ներուժը, սակայն չի արդարացնում ամբողջ զանգվածը միատարր «սևահող» համարելը՝ առանց ուղղաձիգ ու հորիզոնական լրացուցիչ նմուշառման: Իրավադոգմատիկ վերլուծությունը ցույց է տալիս, որ ՀՀ հողային օրենսգրքի 36-րդ հոդվածը և ՀՀ կառավարության N 676-Ն որոշումը շինարարական աշխատանքներից հանված բերրի շերտի վաճառքը թույլատրում են, իսկ պետական և համայնքային հողամասերից ստացված վաճառքի ամբողջ գումարը նախատեսում են համայնքային բյուջեի համար: Միաժամանակ գործող կարգավորումը չի սահմանում մրցակցային գնի ձևավորման, հրապարակային լուտավորման, եկամուտների նպատակային

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օգտագործման կամ երկարատև պատմական պաշարի սեփականության նույնականացման ամբողջական մեխանիզմ: Առաջարկվում է երկաստիճան լուծում՝ անհապաղ կիրառելի բաց էլեկտրոնային աճուրդ՝ որակային դասերով և լոգիստիկայից զատված մեկնարկային գնով, ապա օրենսդրական բարեփոխում՝ Հողային ռեսուրսների վերականգնման նպատակային ենթահաշվով: Սցենարային գնահատմամբ 4,000–8,000 դրամ/մ³ դիտարկվող գների դեպքում համախառն արժեքը կազմում է 850.1 մլն–1.700 մլրդ դրամ, սակայն այդ միջակայքը չի կարող մեխանիկորեն ընդունվել որպես պաշտոնական գին, քանի որ պահանջում է օրինական գործարքների, որակի, ԱԱՀ-ի, բեռնման և փոխադրման պայմանների համադրելի ճշգրտում: Հետազոտությունը համադրում է իրավադոգմատիկ վերլուծությունը, միջազգային Scopus գրականության սինթեզը, որակով ճշգրտված համեմատական ու մնացորդային գնահատումը, սցենարային զգայունությունը և հանրային զուտ արժեքի բազմաչափ մոդելը: Մեկ պաշարի ու չստուգված ոչ ֆորմալ գների պայմաններում էկոնոմետրիկ գործակիցներ չեն գնահատվում. փոխարենը ձևակերպվում է օրինական աճուրդների ապագա միկրոտվյալների հեղուկ գնահատման նույնականացվող մոդել:

Բանալի բաներ. հողի բերրի շերտ, սևահող, բնական կապիտալ, հրապարակային աճուրդ, գնագոյացում, համայնքային բյուջե, հողի վերականգնում, շրջանաձև տնտեսություն, Ախուրյան ջրամբար:

РЫНОЧНОЕ УПРАВЛЕНИЕ ПЛОДРОДНЫМ СЛОЕМ ПОЧВЫ, НАКОПЛЕННЫМ ИЗ ЧАШИ АХУРЯНСКОГО ВОДОХРАНИЛИЩА: СИСТЕМНАЯ МОДЕЛЬ ОЦЕНКИ, ФОРМИРОВАНИЯ ЛОТОВ, ПУБЛИЧНОЙ РЕАЛИЗАЦИИ, РАСПРЕДЕЛЕНИЯ ДОХОДОВ И ПРАВОВЫХ РЕФОРМ

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В статье приводится научно-практическая модель правового и экономического оборота 212 532 м³ плодородного слоя почвы, складированного в окрестностях Ахурянского водохранилища на протяжении примерно четырех десятилетий. Согласно результатам полевых измерений и лабораторных исследований, проведенных в 2026 г., среднее содержание гумуса в складированном грунте составляет 3,54%, тогда как соответствующий показатель фоновой почвы равен 4,54%. Данный факт подтверждает высокий ресурсный потенциал накопленного запаса, однако не дает оснований рассматривать весь его объем как однородный *чернозем* без проведения дополнительного вертикального и горизонтального отбора проб.

Праводогматический анализ показывает, что статья 36 Земельного кодекса Республики Армения и постановление Правительства Республики Армения № 676-Н допускают продажу плодородного слоя почвы, снятого при проведении строительных работ, и предусматривают направление всей суммы, полученной от реализации плодородного слоя, снятого с земельных участков государственной и муниципальной

*A.Kh. Markosyan, V.G. Khachatryan, V.R. Grigoryan, H.V.Tokmajyan***MARKET-BASED MANAGEMENT OF FERTILE TOPSOIL ACCUMULATED FROM THE AKHURYAN RESERVOIR BASIN: A SYSTEMIC MODEL FOR VALUATION, LOT FORMATION, PUBLIC SALE, REVENUE DISTRIBUTION, AND LEGAL REFORM**

собственности, в муниципальный бюджет. Вместе с тем действующее регулирование не устанавливает комплексного механизма конкурентного формирования цены, публичного формирования лотов, целевого использования доходов или идентификации права собственности на исторически сформировавшиеся долгосрочные запасы.

Предлагается двухэтапное решение: на первом этапе — непосредственно применимый открытый электронный аукцион с классификацией по качественным категориям и стартовой ценой, отделенной от логистических затрат; на втором этапе — законодательная реформа с созданием целевого субсчета восстановления земельных ресурсов. Согласно сценарной оценке, при рассматриваемом диапазоне цен 4 000–8 000 драмов/м³ валовая стоимость запаса составляет приблизительно 850,1 млн–1,700 млрд драмов. Вместе с тем данный диапазон не может механически приниматься в качестве официальной цены, поскольку требует сопоставимой корректировки с учетом юридически оформленных сделок, качества почвы, НДС, условий погрузки и транспортировки.

Исследование объединяет праводогматический анализ, синтез международной литературы, индексируемой в Scopus, скорректированные по качеству сравнительный и остаточный методы оценки, сценарный анализ чувствительности и многомерную модель чистой общественной ценности. В условиях наличия одного запаса и непроверенных неформальных ценовых данных эконометрические коэффициенты не оцениваются. Вместо этого формулируется идентифицируемая гедоническая модель оценки для будущих микроданных, формируемых по результатам юридически оформленных аукционных сделок.

Ключевые слова: плодородный слой почвы, чернозем, природный капитал, публичный аукцион, ценообразование, муниципальный бюджет, восстановление земель, циркулярная экономика, Ахурянское водохранилище.

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