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Article

Conceptual Foundations for Expanding the Scope and Increasing the Flow of Separate Accounting Policy for Public–Private Partnership Economic Sectors in the Republic of Uzbekistan

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Abstract: This article develops a conceptual model for extending the separate accounting policy applied to Uzbekistan's public–private partnership (PPP) projects from a single-entity approach to the national scale. Building on an earlier firm-level Accounting Policy Maturity Index (APMI), the study distinguishes two dimensions - scope, the sectoral and administrative coverage of the policy, and flow, the intensity of project, investment and fiscal-information movement - and argues that scope is a necessary but not sufficient condition for flow. A sector-prioritisation matrix based on PPP investment volume and fiscal-risk intensity, a four-level vertical governance architecture, and a multiplicative Scope–Flow Integral Index (SAPII) are proposed, together with a five-stage dynamic improvement cycle (Scope → Flow → Risk Management → Feedback → Improved Policy). Applying the model to six PPP sectors and comparing an inertial scenario with an active-expansion scenario for 2030 shows that full implementation could raise the national SAPII from about 39 to 90 points, lift the private-investment share from 67.5 to 79 percent, and reduce contingent liabilities from 15 to 8 percent of GDP. A phased 2030 road map operationalises the model for policymakers.

Keywords: Public–Private Partnership, Separate Accounting Policy, Fiscal Risk, Contingent Liabilities, Scope–Flow Integral Index, Fiscal Transparency, Private Investment, Uzbekistan, Accounting Policy Maturity Index, National Road Map

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1. Introduction

In an earlier study, a concept-methodological model for maintaining separate accounting policy at the level of an individual economic entity - the Accounting Policy Maturity Index (APMI) - together with a six-formula evaluation apparatus grounded in it, was developed. However, that model was confined to a single entity, and the nationwide expansion of the public–private partnership (PPP) portfolio raises the issue to a qualitatively new level. With Uzbekistan's PPP portfolio reaching 27 percent of GDP, and the contingent liabilities it generates reaching 15 percent of GDP, the fiscal significance of a separate accounting policy can no longer be resolved within the boundaries of a single enterprise. The purpose of this study is therefore to develop the financial-conceptual foundations for extending separate accounting policy from the experience of a single entity (in particular, Uzbekiston Temir Yo'llari JSC) to all PPP sectors - that is, to expand its scope (coverage) and to increase the flow of project, investment and fiscal information.

In this study, separate accounting policy is treated not as a technical accounting matter but as an instrument for ensuring state financial stability and attracting private

investment, because in PPP projects the transparency of accounting directly affects the level of fiscal risk, the hidden growth of public debt, and the risk premium demanded by investors. Methodologically, the study follows the sequence set out below: first, the concepts of 'scope' and 'flow' are conceptualised and the theoretical foundations of the topic are presented through a review of the foreign literature; the current situation is then assessed empirically. The two-dimensional (horizontal and vertical) approach to expanding scope, the three channels for increasing flow, the scope–flow integral index, and the five-stage dynamic cycle are then substantiated. Finally, the model is tested through national quantitative scenarios and a 2030 road map.

2. Materials and Methods

Building on reform-scaling theory (extending a reform from a pilot entity to the whole system) and on fiscal-transparency theory, the study distinguishes two dimensions. Scope denotes the breadth with which separate accounting policy covers economic sectors and levels of governance - that is, the spatial-institutional spread of the policy. Flow denotes the number of projects applying this policy, the private investment they attract, and the speed and volume at which fiscal information is transmitted to the public finance system - that is, the time-quantitative dynamics of the policy. Scope measures how much has been 'covered'; flow measures how intensively and completely the policy is 'working'.

The interrelation of these two dimensions is conceptually decisive: scope is a necessary but not sufficient condition for flow. In other words, formally extending separate accounting policy to new sectors (broadening scope) is highly likely to remain no more than a declarative document unless it is reinforced by mechanisms that activate project and investment flow. For this reason, the present study treats scope and flow within a single conceptual model - as two mutually reinforcing wings.

T. Irwin shows that decisions on extending state guarantees and other contingent liabilities are often suboptimal because of cognitive and political obstacles, and proposes a framework that clarifies the principle of allocating risk to the party best able to manage it. The author develops methods for valuing guarantees in monetary terms and argues that they must become an integral part of public-sector management; this approach serves as the theoretical basis for the risk-intensity-based sector-prioritisation matrix developed in this study [1]

L. Kemoe and Z. Zhan, in an empirical analysis of 33 developing countries, demonstrate that three dimensions of fiscal transparency - openness of the budget process, transparency of fiscal data, and accountability of fiscal actors - reduce the interest-rate spread on public debt and increase foreign demand for sovereign debt; this finding provides external empirical support for the mechanism proposed here, whereby accounting transparency lowers the risk premium and strengthens investment flow, and it reinforces the elasticity finding (+0.293) between the APMI and private investment [2]

A. Cebotari brings together, within a single framework, the nature, management and disclosure of contingent liabilities, and summarises good practice - drawn from country experience - on how to account for, budget and disclose them; the author notes that the tension between political inclination toward hidden support and the demand for transparency is increasingly being resolved in favour of transparency. This analysis is the direct methodological foundation for the idea, proposed here, of maintaining a national contingent-liabilities register and integrating it into the budget process, and it supports the need to institutionalise the fiscal-information flow [3]

Analysis of the current situation shows that separate accounting policy is so far applied mainly in the energy sector - which accounts for more than 93 percent of PPP investment - and, increasingly, in the transport sector, following the example of Uzbekiston Temir Yo'llari JSC. The remaining sectors - utilities, social infrastructure, education and healthcare - hold only a marginal share of PPP investment. This indicates

that scope is narrow and flow is low, and that, as a result, systematic monitoring of fiscal risk is insufficient.

A factor that heightens the strategic urgency of the problem is that, under Presidential Resolution No. PQ-308 of 30 August 2024, new PPP projects worth USD 30.2 billion are planned for 2025–2030. If a flow of new obligations of this scale is not covered by a transparent accounting policy, it will heighten the risk that contingent liabilities are insufficiently accounted for and monitored, and that the state's contingent and long-term fiscal obligations continue to grow. Increasing scope and flow is therefore not only a methodological issue but also a matter of fiscal security.

3. Result and Discussion

Horizontal and vertical expansion of scope

It is proposed that the scope of separate accounting policy be expanded along two dimensions - horizontal (across sectors) and vertical (across levels of governance).

Horizontal expansion envisages the sequential coverage of sectors. Covering all sectors simultaneously is not feasible in resource terms, so the study proposes a combination of two factors as the criterion for prioritising sectors: the volume of PPP investment (the scope factor) and the intensity of fiscal risk (the risk factor). The prioritisation matrix built on these two factors divides sectors into three priority tiers and enables the state to direct its limited resources toward the directions with the greatest fiscal impact (Table 1).

Table 1. Sector prioritisation matrix for introducing separate accounting policy across PPP sectors [4]

Sector	PPP investment share, %	Fiscal risk intensity	Current APMI, points	Priority tier
Energy	93.1	High	~74	I (baseline)
Transport	0.28 (2025–2030 plan – $30.2 bn)	High	73.6 (UTY JSC)	I (priority)
Utilities	4.68	Medium	–	II
Social infrastructure / healthcare	0.50	Medium	–	II
Education	0.76	Low	–	III
Agro-industry & others	<0.1	Low	–	III

Analysis shows that, despite the sharp difference in their investment shares, the energy sector (93.1%) and the transport sector are grouped into Priority Tier I because both combine with high fiscal-risk intensity: energy is classified as 'baseline' because of its already vast existing portfolio, while transport is classified as 'priority' because of the USD 30.2 billion pipeline of new projects planned for 2025–2030 - that is, priority is determined not only by current volume but also by future risk potential. Utilities and social infrastructure, at a medium risk level, fall into Tier II, while education and agro-industry, with low shares and low risk, fall into Tier III. In this way the matrix allows the state to direct its limited institutional resources step by step toward the sectors with the greatest fiscal impact - that is, to carry out horizontal expansion in a risk-based order (Figure 1).

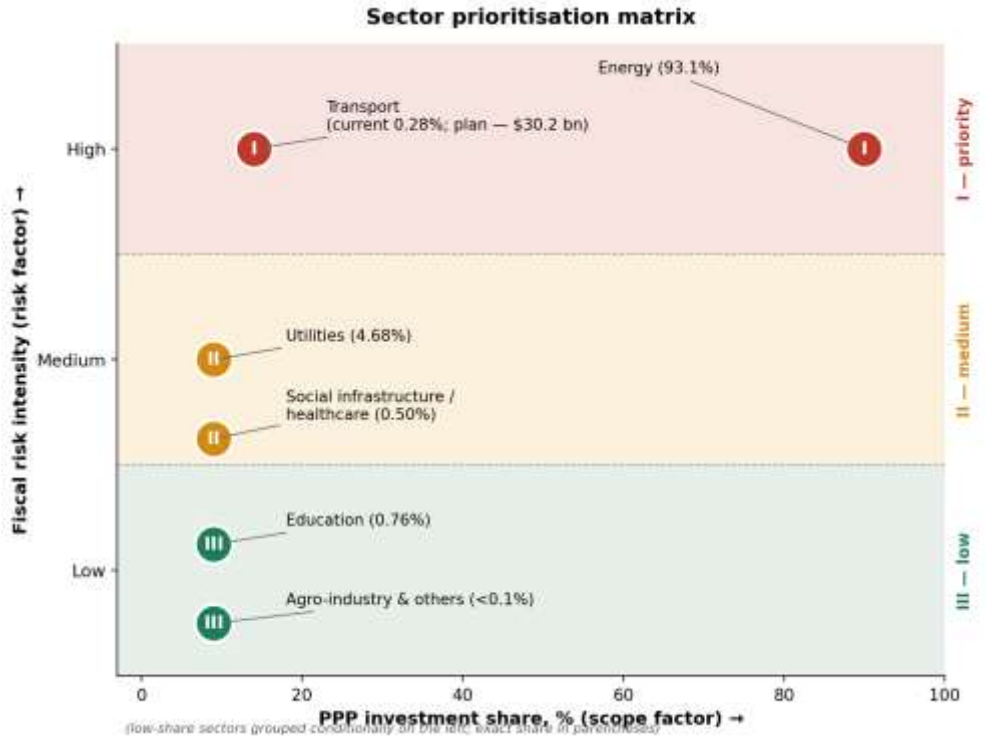


Figure 1. Prioritisation matrix for PPP sectors by scope and fiscal-risk dimensions [5]

Vertical expansion envisages integrating separate accounting policy into a single interconnected system across four levels of governance - central government, sector (ministry/company), enterprise/special-purpose vehicle (SPV), and project level. Here, the firm-level APMI developed in the earlier study is retained as the lowest tier, but its results are transmitted upward to the sector and national fiscal-framework levels. As a result, the information generated at each level is relayed to the level above as feedback and forms the basis for management decisions. In this way, separate accounting policy becomes a multi-tier architecture that unites a bottom-up flow of information with a top-down flow of standards and requirements (Figure 2).



Figure 2. Conceptual model for the national-scale expansion (scope) and flow enhancement of separate accounting policy [6]

Three channels for increasing flow

As noted above, expanding scope remains declarative unless it is backed by mechanisms that increase flow. The study therefore identifies three interrelated channels for enhancing flow: project flow, investment flow, and fiscal-information flow.

First, project flow. It is proposed that the requirement of separate accounting policy be set as a mandatory 'entry condition' already at the project-preparation stage. Here, the PPP Project Centre established under the Ministry of Economy and Finance by Resolution No. PQ-308, together with the PPP Fund, would verify that the financial structure of every new project complies with the separate-accounting standard. As a result, the flow of projects entering the system is provided with transparent accounting from the earliest stage, which reduces the risk of subsequent renegotiation and cost overruns.

Second, investment flow. The financial effect of separate accounting policy is manifested directly in the flow of private investment. According to the elasticity coefficient estimated in the earlier study, a one-point increase in the APMI raises the share of private investment by an average of 0.293 percentage points and reduces the share of contingent liabilities by 0.214 percentage points. This relationship is explained by the fact that accounting transparency lowers the risk signal for investors, reducing the required risk premium and thereby strengthening the flow of private investment nationwide. According to the forecast developed in the earlier study, full implementation of separate accounting policy would raise the share of private investment from 67.5 percent to 79 percent.

Third, fiscal-information flow. Contingent liabilities identified through separate accounting policy are consolidated into the national contingent-liabilities register and transmitted to the budget process and the public-debt-management strategy. This institutionalises the exchange of information between the Ministry of Economy and Finance and the Central Bank and makes it possible to identify, in advance, the hidden impact of PPP projects on macroeconomic stability. It is through this very channel that the reduction of contingent liabilities from 15 percent to 8 percent of GDP can be achieved. The three channels of flow, the mechanisms that drive them, and institutional responsibility are summarised in Table 2.

Table 2. Channels, mechanisms and financial outcome of enhancing separate-accounting-policy flow [7]

Flow channel	Driving mechanism	Institutional responsibility	Expected financial outcome
Project flow	Setting the separate-accounting requirement as a mandatory 'entry condition' at project preparation	PPP Project Centre; PPP Fund	Reduced risk of cost overruns and renegotiation
Investment flow	Lowering the risk premium through segmented, transparent reporting (elasticity +0.293 p.p.)	Sector companies; SPVs	Private investment share 67.5% → 79%
Fiscal-information flow	National contingent-liabilities register and transmission to the budget	Ministry of Economy and Finance; Central Bank	Contingent liabilities 15% → 8% of GDP

The Scope–Flow Integral Index (SAPII)

In order to combine scope and flow into a single quantitative indicator and to track national-level dynamics, the study proposes a Separate Accounting Policy Integral Index (SAPII). The index is built from two components - the scope sub-index (S) and the flow sub-index (F). The scope sub-index measures coverage across sectors and levels of

governance, while the flow sub-index measures the intensity of project, investment and information flows:

$$S = \frac{\Sigma_{i,j}\, \theta_i \cdot c_{ij}}{L} \quad (4.7)$$

$$F = F_{pa} \cdot F_{ib} \cdot F_{xc},\ a + b + c = 1 \quad (4.8)$$

$$AHSII = S_{\alpha} \cdot F_{\beta},\ \alpha + \beta = 1 \quad (4.9)$$

where N is the number of sectors that must be covered; L is the number of levels of governance (4); c_{ij} is the coverage coefficient of sector i at level j (0…1); θ_i is the fiscal weight of sector i (a weight normalised by PPP-investment share and risk share, with $\Sigma\theta_i = 1$); F_p, F_i, F_x are, respectively, the project-, investment- and information-flow sub-indices (0…1); a, b, c are the weights of the flow channels (a + b + c = 1); α, β are, respectively, the weights of scope and flow ($\alpha + \beta = 1$). Because the θ_i weights are normalised so that $\Sigma\theta_i = 1$, the sum in the numerator of (1) need only be divided by L; as a result S, F ∈ [0, 1], and the final index is rescaled to a 0…100 scale.

An important conceptual feature of the integral index is that it is constructed multiplicatively (geometrically). If the flow sub-index tends to zero (F→0), SAPII also falls to zero, however high scope (S) may be. This expresses, in mathematical form, the thesis that 'scope is a necessary but not sufficient condition for flow': formally extending separate accounting policy to many sectors does not translate into an integral effect unless it is powered by a real flow of projects and investment. In the current situation, because F is low, the national SAPII stands at a low level; raising it is to be ensured through the mechanisms proposed in the following subsections [8]

To calculate the integral index in practice, three operational elements must be determined in sequence: the Fiscal Risk Index (FRI), the sector's fiscal weight (θ_i), and the flow sub-indices (F_p, F_i, F_x). These are presented step by step below.

a) Fiscal Risk Index (FRI). To place the qualitative 'High/Medium/Low' ratings of Table 1 on a quantitative footing, a composite fiscal-risk index is proposed for each sector. The FRI is constructed as the weighted sum of five risk components:

$$FRI_i = \Sigma_{k=1}^{m} w_k \cdot r_{ik},\quad \Sigma_k w_k = 1 \quad (4)$$

where r_{ik} is the value of risk component k for sector i, min–max normalised to the [0, 1] range, and w_k is the weight of the component. The components and their weights are given in Table 3. The FRI_i value is multiplied by 100 and mapped to quality categories: 0–33 Low, 34–66 Medium, 67–100 High; in this way the qualitative ratings in Table 1 acquire a quantitative basis.

Table 3. Components and weights of the Fiscal Risk Index (FRI) [9]

Risk component (r_{ik})	Definition and measurement method	Weight (w_k)
Contingent-liabilities exposure	Ratio of state guarantees and contingent liabilities to the sector's PPP investment	0.30
Revenue and demand guarantees	Presence and scale of minimum revenue or demand guarantees	0.20
Accounting-transparency deficit	1 − $APMI_i$ / 100 (low maturity → high hidden risk)	0.20
Currency and macroeconomic sensitivity	Share of obligations denominated in foreign currency	0.15
Maturity and renegotiation risk	Normalised score based on average contract term and complexity	0.15

b) Sector fiscal weight (θ_i). The weight θ_i in the scope sub-index (1) combines both the size and the risk of a sector and is directly linked to the prioritisation logic ('scope × risk'):

$$\theta_i = (s_i \cdot FRI_i) / \Sigma_k (s_k \cdot FRI_k) \quad (5)$$

where s_i is the sector's prospective share of PPP investment (based on the current portfolio and the 2025–2030 plan under Resolution No. PQ-308). The multiplicative form gives a sector a high weight not because it is large or risky alone, but because it is a priority on both dimensions at once; the normalisation in the denominator ensures that $\Sigma\theta_i = 1$.

c) Flow sub-indices (F_p, F_i, F_x). The three channels of flow are each measured on a 0…1 scale as follows: F_p - the ratio of new projects prepared to the separate-accounting standard to their total number; F_i - the ratio of private investment attracted into transparently accounted projects to total PPP private investment; F_x - the ratio of contingent liabilities consolidated in the register and transmitted to the budget to all identified contingent liabilities. These three indicators are combined into a single flow sub-index F through formula (2).

d) Calculation steps. SAPII is calculated in the following sequence:

Step 1. For each sector i, the coverage coefficients c_{ij} (0…1) at the four levels of governance are determined on the basis of expert and documentary assessment.

Step 2. The risk components r_{ik} are collected, normalised to the [0, 1] range, and FRI_i is calculated using (4).

Step 3. Using the prospective investment share s_i and FRI_i, θ_i is calculated using (5).

Step 4. The scope sub-index S is calculated using (1).

Step 5. F_p, F_i and F_x are determined, and the flow sub-index F is calculated using (2).

Step 6. SAPII = $S^a \cdot F^b$ is calculated using (3), rescaled to 0…100, and interpreted as follows: 0–40 - initial (low maturity); 41–70 - developing; 71–100 - mature.

To illustrate the practical application of the methodology, an illustrative (conditional) calculation for six sectors is presented in Table 4.

Table 4. Illustrative example of the SAPII calculation (by sector) [10]

Sector	s_i, % (prospective)	FRI_i	θ_i	$\hat{c}_i$ (2024)	$\hat{c}_i$ (2030)
Energy	55	0.80	0.58	0.75	0.95
Transport	30	0.85	0.34	0.55	0.90
Utilities	8	0.50	0.05	0.05	0.80
Social infrastructure	3	0.48	0.02	0.03	0.75
Education	2.5	0.20	0.007	0.02	0.70
Agro-industry & others	1.5	0.16	0.003	0.01	0.65

On the basis of these values, the scope sub-index calculated by (1) is $S_{2024} \approx 0.62$ and $S_{2030} \approx 0.92$; the flow sub-index (at baseline dimensions) is $F_{2024} \approx 0.25$ and $F_{2030} \approx 0.88$. Applying (3) with $\alpha = \beta = 0.5$, the resulting national SAPII is therefore ≈ 39 points in 2024 (initial level) and ≈ 90 points in 2030 (mature level). This result is fully consistent with the active-expansion scenario in Table 5 and with the road map's target indicators ('SAPII 90+'), confirming the practical measurability of the integral index.

The five-stage dynamic cycle

Scope and flow are not a static state but the first two stages of a continuously improving process. The study proposes modelling separate accounting policy as a closed five-stage cycle (Scope → Flow → Risk Management → Feedback → Improved Policy).

This cycle shows that the policy is not a one-off measure but a self-reinforcing management loop (Figure 3).

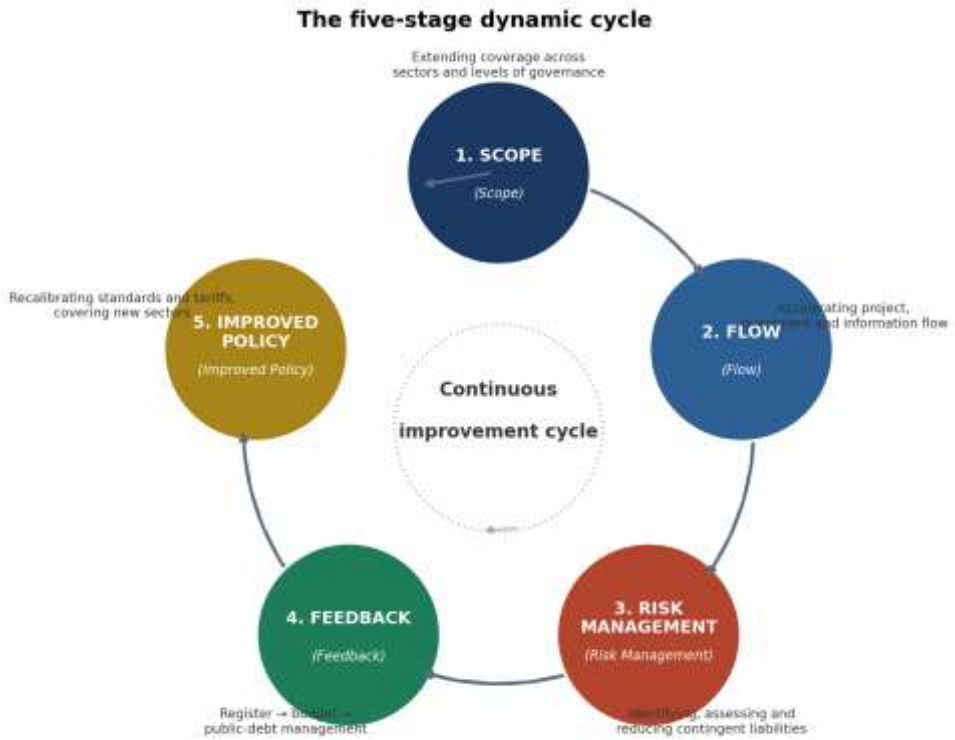


Figure 3. The five-stage dynamic cycle of separate accounting policy [11]

The logic of the cycle is as follows: scope (1) widens coverage; flow (2) accelerates the movement of projects, investment and information; risk management (3) assesses and reduces the contingent liabilities identified through this flow; feedback (4) relays the results to the central level through the register and the budget; and improved policy (5) recalibrates standards, tariffs and coverage, restarting the cycle with new sectors. Each rotation raises the SAPII value, which gives the model its dynamic, self-improving character.

The conceptual model for increasing scope and flow can operate effectively in practice only where the corresponding institutional and financial support exists. Three elements are of particular importance here. The first is maintaining a national contingent-liabilities register and integrating it into the budget process. The second is introducing an audit under International Financial Reporting Standards (IFRS) and an international credit rating; these mechanisms increase the reliability and transparency of financial information, allow the state's contingent and long-term fiscal obligations to be identified and assessed more fully, and serve to accelerate investment flow. The third is tariff methodology and the targeted allocation of subsidies, which makes it possible to identify the interdependence among tariffs, costs and subsidies and to assess the potential fiscal burden arising from cross-subsidisation.

This conceptual model is directly aligned with the objectives of the 'Uzbekistan – 2030' strategy, which envisages raising GDP to USD 160 billion by 2030 and increasing the share of private investment in infrastructure. Increasing the scope and flow of separate accounting policy serves precisely as the financial instrument for achieving these objectives, since it strengthens the flow of private investment while simultaneously protecting the state's fiscal stability.

Dynamic trajectories and national scenarios

The matrix in Figure 1 reflects the current position of the sectors. But as separate accounting policy is implemented, sectors' positions on the matrix shift: as coverage (scope) widens, they move to the right, and as accounting maturity increases and fiscal risk becomes managed, they move downward. The static matrix is therefore rendered dynamic - the trajectory of each sector from its 2024 position to its 2030 target position is shown (Figure 4).

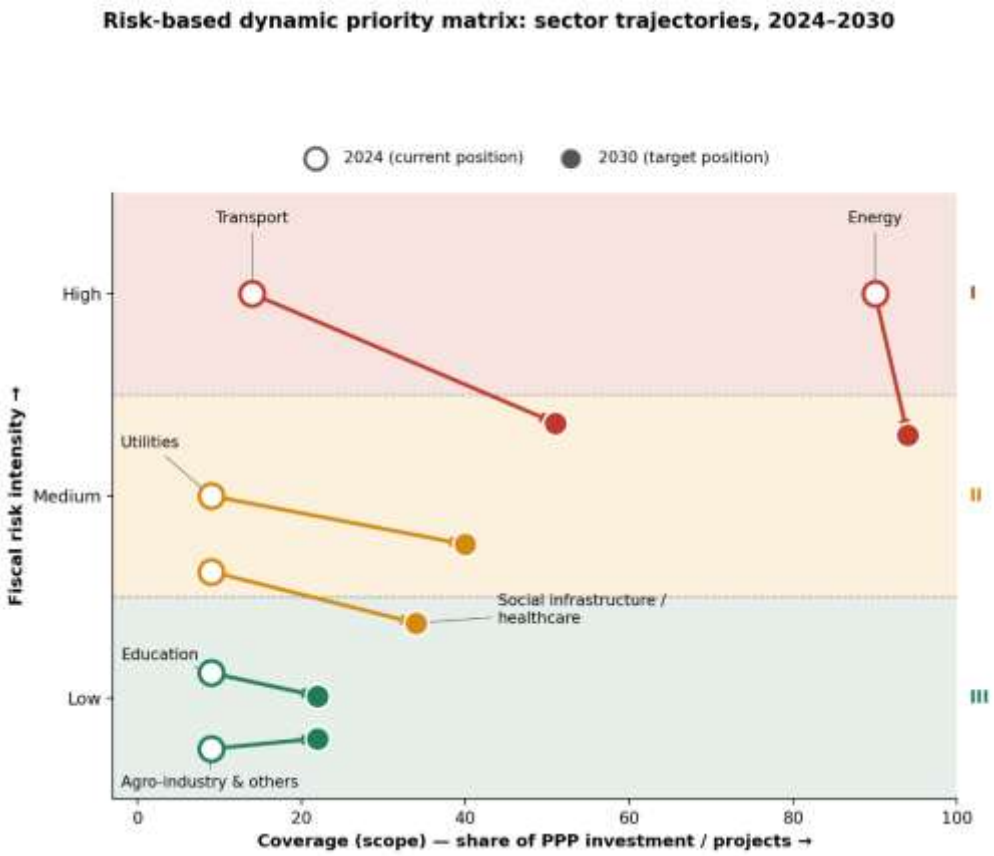


Figure 4. Risk-based dynamic priority matrix: sector trajectories, 2024–2030 [12]

The diagram shows the main dynamic effect of separate accounting policy: all sectors move in a down-and-to-the-right direction - that is, coverage widens and managed fiscal risk falls. As its USD 30.2 billion portfolio is brought under coverage, transport moves from the high-risk zone to the medium zone; energy reduces its risk by deepening accounting maturity; while utilities and social infrastructure move to a higher level of transparency as they are brought into coverage. This demonstrates that priorities change dynamically over time: once one sector is brought under control, resources are redirected to the next priority direction.

To assess the expected macroeconomic effect of the proposed conceptual model, the forecasting apparatus developed in the earlier study was extended to the national level, and two scenarios were compared: inertial (if the current policy continues) and active expansion (if the scope and flow mechanisms are fully implemented). The results are given in Table 5.

Table 5. National scenarios for increasing the scope and flow of separate accounting policy (2030 forecast) [13]

Indicator	2024 (base)	Inertial scenario, 2030	Active expansion, 2030
Number of sectors covered by separate accounting	2 (energy, transport)	3	6
Average APMI (national), points	~55	70	90+
Contingent liabilities, % of GDP	15	12–13	8
Private investment share, %	67.5	71	79
Interest burden to revenue ratio, %	7.2	6.5	<5

Comparing the scenarios shows that increasing the scope and flow of separate accounting policy is not incidental but a measurable fiscal-investment outcome. Unlike the inertial path, the active-expansion scenario makes it possible to bring contingent liabilities down to the international norm (8 percent of GDP) and to raise the share of private investment to 79 percent. This confirms that the nationwide expansion of separate accounting policy is a strategic lever for ensuring state financial security.

A phased 2030 road map

To put the conceptual model, the integral index and the dynamic matrix substantiated above into practice, a phased road map is proposed. The road map is divided into three phases corresponding to the three tiers of the prioritisation matrix, with a specific institutional measure and target indicator defined for each phase (Figure 5, Table 6).

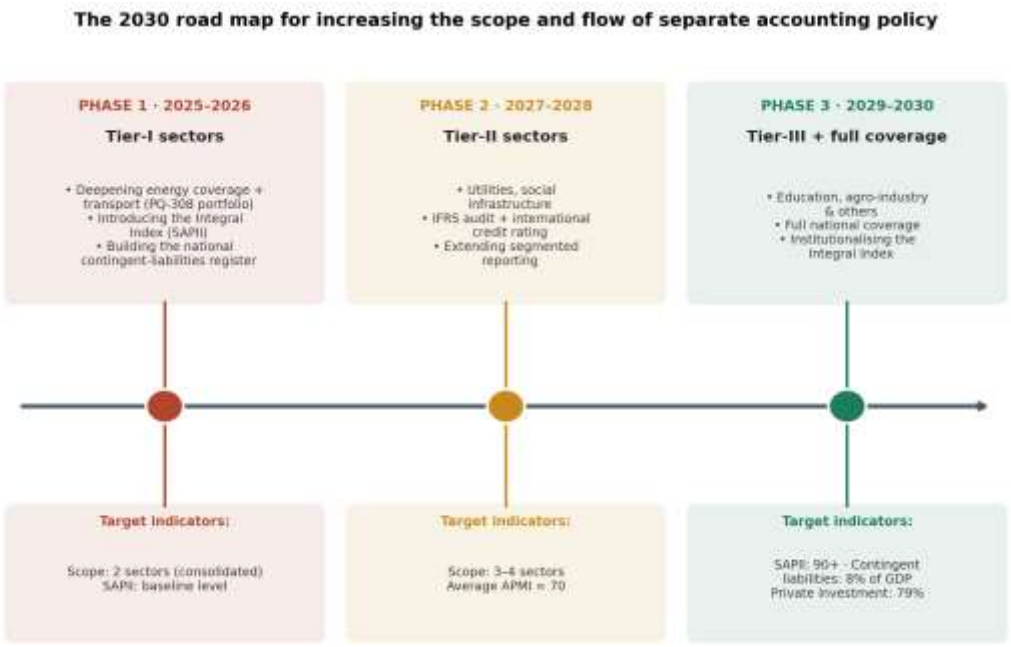


Figure 5. The 2030 road map for increasing the scope and flow of separate accounting policy [14]

The road map in Figure 5 arranges the three phases sequentially on a single time axis: each phase is marked in a colour matching its priority tier (I, II, III), with the main measures

to be implemented shown at the top and the target indicators to be achieved shown at the bottom. The phases are interlinked and cumulative in nature: the measurement tools established in the first phase (the integral index and the contingent-liabilities register) lay the foundation for broadening coverage in later phases, while the international transparency mechanisms of the second phase financially reinforce the full national coverage of the third. A detailed description of the sectors covered, the institutional measure and the specific target indicator for each phase is given in Table 6.

Table 6. Phased road map for the nationwide expansion of separate accounting policy [15]

Phase (period)	Sectors covered (tier)	Key institutional measure	Target indicator
Phase 1 (2025–2026)	Tier I: energy (deepening), transport (PQ-308 portfolio)	Introducing the Integral Index (SAPII) and the national contingent-liabilities register	Scope – 2 sectors (consolidated); SAPII – baseline level
Phase 2 (2027–2028)	Tier II: utilities, social infrastructure	IFRS audit and international credit rating; extending segmented reporting	Scope – 3–4 sectors; average APMI ≈ 70
Phase 3 (2029–2030)	Tier III: education, agro-industry & others; full national coverage	Institutionalising the Integral Index; full transparency and feedback	SAPII – 90+; contingent liabilities – 8% of GDP; private investment – 79%

The road map links the elements of the model into a single practical sequence: in the first phase the measurement tools (the integral index and the register) are established; in the second phase coverage is extended to medium-risk sectors and international transparency mechanisms are introduced; and in the third phase full national coverage and the target fiscal-investment indicators are achieved. This sequence ties each rotation of the five-stage cycle to a specific time interval, turning the model into a real management plan.

4. Conclusion

The principal scientific result of this study is the development of an integrated conceptual model for extending separate accounting policy from the firm level to the national scale (scope) and for accelerating it through project, investment and fiscal-information flows (flow). The scientific novelty of the model is expressed in five respects. First, a prioritisation matrix was proposed for ranking sectors by the volume of PPP investment and the intensity of fiscal risk. Second, separate accounting policy was presented as a multi-tier architecture linking four levels of governance and resting, at its lowest tier, on the APMI model. Third, a Scope–Flow Integral Index (SAPII) combining scope and flow into a single indicator was substantiated, together with a five-stage dynamic cycle - Scope → Flow → Risk Management → Feedback → Improved Policy - that continually updates it. Fourth, a risk-based dynamic priority matrix reflecting sectors' 2024–2030 trajectories was developed. Fifth, the model was substantiated quantitatively and practically through national scenarios and a phased 2030 road map.

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[4] Author's own compilation based on the sectoral distribution of PPP investment during 2020–2024 and the data of Presidential Resolution No. PQ-308.

[5] Author's own compilation based on the data presented in Table 1. The horizontal axis represents the share of PPP investment (scope factor), while the vertical axis represents the intensity of fiscal risk (risk factor).

[6] Author's own compilation. The four-level architecture consists of a top-down flow of standards and requirements and a bottom-up flow of information and feedback. At the lowest tier, the firm-level APMI model serves as the operational basis.

[7] Author's own compilation based on the elasticity estimates presented in Chapter 2 and the forecast results of Section 3.4.

[8] Author's own compilation. The weights a, b, c, α, and βmay be calibrated through expert assessment or principal component analysis (PCA). Equal weights (α=β=0.5; a=b=c=1/3) are adopted as the baseline variant.

[9] Author's own compilation. The component weights w_kare determined on the basis of expert assessment and may alternatively be calibrated through principal component analysis (PCA) or the analytic hierarchy process (AHP).

[10] Author's own compilation using illustrative conditional values. s_idenotes the prospective investment share based on the current portfolio and the PQ-308 plan, while cˆ_idenotes the sector's average coverage coefficient across governance levels (0–1).

[11] Author's own compilation. The closed-cycle model demonstrates that each rotation increases the value of the Separate Accounting Policy Integral Index (SAPII).

[12] Author's own compilation based on the data presented in Figure 1 and Table 5. The open marker indicates the current position in 2024, the filled marker indicates the target position in 2030, and the arrow represents the transition trajectory.

[13] Author's forecast based on the logistic-growth model and Monte Carlo simulation results presented in Section 3.4 using baseline indicators for 2020–2024. The active-expansion scenario assumes full implementation of the proposed recommendations.

[14] Author's own compilation based on the three tiers of the prioritization matrix and the implementation phases of Presidential Resolution No. PQ-308.

[15] Author's own compilation. The target indicators are established in accordance with the active-expansion scenario presented in Table 5.