

Integral Assessment of The Impact of Shadow and Hidden Economy on Sustainable Economic Development Through Factors

 Najmiddinov Yakhyo Fazliddin ugli

PhD, “Green” economy department, Tashkent state university of economics, Uzbekistan

 Adilova Marguba Tursunaliyevna

PhD, “Green” economy department, Tashkent state university of economics, Uzbekistan

 Jamalov Bejan Khurshidovich

Assistant of the “Green” economy department, Tashkent state university of economics, Uzbekistan

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Abstract

This article examines the impact of the shadow and hidden economy on sustainable economic development through an integral assessment approach. The study is based on the theoretical and methodological foundations of the non-observed, informal and shadow economy developed by international organizations and previous empirical studies. The research proposes a factor-based integral framework that combines indicators related to fiscal stability, informal employment, cash circulation, institutional transparency, investment activity and socio-economic sustainability. Using the case of Uzbekistan, the article assesses how shadow and hidden economic activity affects the quality of sustainable economic development by reducing tax revenues, weakening formal employment, distorting statistical information and limiting the effectiveness of public policy. The study applies normalization, weighted aggregation and regression-based analysis to construct an integral index reflecting the pressure of the shadow and hidden economy on sustainable development. The results indicate that an increase in the shadow and hidden economy pressure has a negative effect on sustainable economic development, particularly through fiscal losses, lower institutional efficiency and reduced transparency of economic activity. The proposed integral assessment approach can be used as a methodological tool for monitoring hidden economic risks and developing policy measures aimed at formalization, digitalization, tax administration improvement and long-term sustainable growth.

Keywords: Shadow economy, hidden economy, informal economy, sustainable economic development, integral assessment, non-observed economy, Uzbekistan, digitalization, tax administration.

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1. Introduction

The shadow and hidden economy is one of the key

structural challenges that limits the transparency, efficiency and sustainability of national economic development. In many countries, especially in transition and developing economies, a significant part of economic activity is carried out outside official registration, taxation, labor protection and statistical observation. As a result, the state loses part of its fiscal capacity, official macroeconomic indicators become less accurate, and the effectiveness of public policy is weakened.

In international statistical practice, the shadow economy is closely related to the broader concept of the non-observed economy[1]. According to the OECD, the non-observed economy includes underground production, illegal production, informal sector activities, household production for own final use, and other economic activities that are not fully captured by regular statistical systems. This approach is important because it shows that hidden economic activity is not limited only to illegal operations, but also includes underreported, unregistered and statistically uncovered forms of production and income generation.

The International Labor Organization also emphasizes that informality should be studied not only as an enterprise-level phenomenon, but also through informal employment, working conditions and social protection[2]. Informal employment often provides income for households, but at the same time it is associated with low labor security, unstable income, weak social guarantees and limited access to formal institutions. Therefore, the shadow and informal economy is not only a fiscal or statistical problem, but also a social and institutional challenge for sustainable development.

Previous empirical studies show that the shadow economy is influenced by several factors, including tax burden, quality of public services, regulation intensity, institutional efficiency, labor market conditions and the level of cash circulation. Medina and Schneider, using international data for 158 countries, show that the shadow economy remains a large and persistent phenomenon across the world[3]. Similarly, Schneider, Buehn and Montenegro argue that weak institutions, excessive regulation and high tax pressure are among the main drivers of shadow economic activity[4].

For Uzbekistan, the issue of the shadow and hidden economy is particularly relevant. Existing studies indicate that the country has experienced a gradual

transformation of economic institutions, tax administration and digital governance. Donaev's empirical study estimates the size of the shadow economy in Uzbekistan using the MIMIC model, while recent assessments by the Institute of Macroeconomic and Regional Studies apply Gutmann's monetary approach based on cash circulation and dollarization[5]. In addition, national studies distinguish between the informal economy and the hidden economy, showing that both components have a significant influence on GDP, employment, budget revenues and the quality of economic growth.

Although many studies focus on measuring the size of the shadow economy, fewer studies examine its integral impact on sustainable economic development. Sustainable development cannot be assessed only through GDP growth; it also requires the consideration of fiscal stability, formal employment, investment activity, income distribution, institutional transparency and social welfare. Therefore, there is a need for a comprehensive factor-based approach that evaluates how shadow and hidden economic activity affects sustainable development through several interrelated indicators.

The main purpose of this article is to develop an integral assessment framework for evaluating the impact of the shadow and hidden economy on sustainable economic development. The study proposes a system of factors and composite indicators that reflect both the pressure of hidden economic activity and the quality of sustainable economic development. This approach makes it possible to identify the direction and strength of the relationship between the shadow economy and sustainable development, as well as to develop policy recommendations aimed at formalization, digitalization, tax administration improvement and long-term economic sustainability.

2. Literature Review

Theoretical and empirical studies on the shadow economy show that this phenomenon has multiple causes and consequences. Schneider, Buehn and Montenegro argue that the main drivers of the shadow economy include tax and social security contribution burdens, intensity of regulation, quality of public sector services and the state of the official economy. Their World Bank study covering 162 countries demonstrates that the shadow economy tends to be larger where institutional quality is weaker and regulation is more burdensome[6].

The concept of the non-observed economy is broader than the shadow economy. It includes all productive activities that are not captured in official statistics. This distinction is important because some unobserved activities may be legal but unregistered, while others may be deliberately hidden to avoid taxes or legal requirements. The OECD framework provides a systematic basis for ensuring exhaustive national accounts and improving the coverage of GDP estimates[7].

The informal economy is also closely connected with labor market conditions. The ILO manual highlights that informal employment is often associated with low income security, weak labor protection and vulnerability to economic shocks. Therefore, informality is not only a statistical issue, but also a social and development issue[8].

In the case of Uzbekistan, recent studies distinguish between informal and hidden economic activity. One study indicates that, according to 2024 official statistics, the informal economy accounted for 26.4 percent of GDP, while the hidden economy accounted for 8.4 percent. Together, they represent a substantial part of economic activity, especially in trade, catering, construction and transport services. This confirms the need to evaluate not only the scale of the shadow economy, but also its systemic impact on sustainable development[9].

3. Methodology

This study applies an integral index-based methodology. The empirical framework consists of four main stages.

First, raw statistical indicators are collected for 2010-2024. These indicators include GDP growth, GDP per capita, household income per capita, investment-to-GDP ratio, unemployment rate, Gini coefficient, informal economy share, hidden economy share, and the total share of informal and hidden economy in GDP.

Second, all indicators are normalized using the min-max method. For positive indicators, where a higher value represents better development performance, the following formula is applied:

$$N_{it} = \frac{X_{it} - X_{min}}{X_{max} - X_{min}} \quad [10]$$

For negative indicators, where a higher value indicates greater pressure or risk, the inverse formula is used:

$$N_{it} = \frac{X_{max} - X_{it}}{X_{max} - X_{min}} \quad [11]$$

Third, two composite indices are constructed. The first one is the Sustainable Economic Development Integral Index (SEDII). It includes GDP growth, GDP per capita, income per capita, investment-to-GDP ratio, unemployment rate and the Gini coefficient. The second one is the Shadow and Informal Economy Pressure Index (SIEPI). It includes the share of the informal economy, the share of the hidden economy and the total share of informal and hidden economic activity in GDP.

4. Results and Discussion

At the initial stage of the empirical analysis, a system of key indicators was selected to assess the impact of the shadow and hidden economy on sustainable economic development. The selected indicators include gross domestic product, GDP growth rate, GDP per capita, the share of the shadow economy, the share of the hidden economy, and the total share of the informal economy for the period 2010-2025. These variables were chosen because they reflect both the positive dynamics of economic development and the negative pressure created by non-observed economic activity. GDP, GDP growth and GDP per capita represent the scale, dynamics and quality of economic development, while the shares of the shadow, hidden and informal economy indicate the extent to which economic activity remains outside official registration, taxation and institutional regulation. Therefore, the first stage of the research focused on forming a balanced empirical database that makes it possible to compare the expansion of the official economy with the changing scale of informal and hidden economic activity.

Table - 1

Dynamics of GDP and the shares of shadow, hidden and informal economy in Uzbekistan, 2010-2025[12]

Year	GDP	GDP growth	GDP per capita	Shadow Economy	Hidden Economy	Informal Economy
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2010	88,102.4	107.7	3,084.6	34.2	7.6	41.7
2011	115,627.8	108.1	3,941.0	38.4	7.6	45.9
2012	142,333.0	107.4	4,780.4	36.7	7.3	44.0
2013	173,201.5	107.9	5,727.0	36.5	8.0	44.5
2014	210,998.3	107.7	6,860.0	36.8	8.1	44.9
2015	250,544.6	107.9	8,004.9	38.9	7.6	46.6
2016	290,213.4	106.7	9,112.5	40.6	7.7	48.3
2017	369,612.8	104.7	11,411.8	38.6	7.0	45.6
2018	494,814.8	105.7	15,014.4	34.7	6.9	41.6
2019	620,083.2	106.8	18,465.6	31.5	7.4	38.9
2020	705,076.5	101.6	20,596.9	30.8	6.5	37.2
2021	861,170.8	108.2	24,664.7	29.7	7.2	36.9
2022	1,041,877.9	106.1	29,226.7	27.2	7.4	34.6
2023	1,261,806.0	106.3	34,653.2	26.7	7.8	34.4
2024	1,535,431.7	106.7	41,306.7	26.5	7.9	34.3
2025	1,849,650.0	107.7	48,816.4	19.0	7.9	26.9

The table presents the dynamics of Uzbekistan's GDP, GDP growth, GDP per capita, and the shares of the shadow, hidden and informal economy during 2010–2025. The data show that GDP increased steadily from 88,102.4 billion soums in 2010 to 1,849,650.0 billion soums in 2025, while GDP per capita rose from 3,084.6 thousand soums to 48,816.4 thousand soums over the same period. At the same time, the share of the shadow economy decreased significantly from its peak of 40.6 percent in 2016 to 19.0 percent in 2025. The total share

of the informal economy also declined from 48.3 percent in 2016 to 26.9 percent in 2025, indicating a gradual reduction in non-observed economic activity. However, the hidden economy remained relatively stable, fluctuating between 6.5 and 8.1 percent. Overall, the table demonstrates that economic growth and improvements in GDP per capita were accompanied by a gradual decline in the shadow and informal economy, which suggests a strengthening of formal economic activity and institutional transparency.

Table-2

Normalized indicators for constructing the integral index of sustainable economic development[13]

Year	GDP _n (+)	GDP growth _n (+)	GDP per capita _n (+)	Shadow Economy _n (-)	Hidden Economy _n (-)	Informal Economy _n (-)
2010	0.0000	0.9242	0.0000	0.2963	0.3125	0.3084
2011	0.0156	0.9848	0.0187	0.1019	0.3125	0.1121
2012	0.0308	0.8788	0.0371	0.1806	0.5000	0.2009
2013	0.0483	0.9545	0.0578	0.1898	0.0625	0.1776
2014	0.0698	0.9242	0.0826	0.1759	0.0000	0.1589
2015	0.0922	0.9545	0.1076	0.0787	0.3125	0.0794
2016	0.1147	0.7727	0.1318	0.0000	0.2500	0.0000
2017	0.1598	0.4697	0.1821	0.0926	0.6875	0.1262
2018	0.2309	0.6212	0.2609	0.2731	0.7500	0.3131
2019	0.3020	0.7879	0.3363	0.4213	0.4375	0.4393
2020	0.3502	0.0000	0.3829	0.4537	1.0000	0.5187
2021	0.4389	1.0000	0.4719	0.5046	0.5625	0.5327
2022	0.5414	0.6818	0.5716	0.6204	0.4375	0.6402

2023	0.6663	0.7121	0.6903	0.6435	0.1875	0.6495
2024	0.8216	0.7727	0.8358	0.6528	0.1250	0.6542
2025	1.0000	0.9242	1.0000	1.0000	0.1250	1.0000

The table presents the normalized values of the selected indicators used to construct the integral index of sustainable economic development. In this stage, GDP, GDP growth and GDP per capita were treated as positive indicators, since their increase contributes to sustainable economic development, while the shares of the shadow, hidden and informal economy were treated as negative indicators, because their growth weakens fiscal stability, institutional transparency and the formal economic sector. The normalization results make indicators with different units and scales comparable within a single methodological framework. The data show that the

normalized values of GDP and GDP per capita increased steadily during 2010-2025, reflecting the expansion of the official economy and improvement in development quality. At the same time, the normalized values of the shadow and informal economy indicators improved after 2016, indicating a gradual reduction in non-observed economic pressure. Therefore, these normalized indicators provide the quantitative basis for calculating the integral index and assessing the relationship between economic growth and the reduction of shadow, hidden and informal economic activity.

Table-3

Weighted Components and Values of the Sustainable Economic Development Integral Index (SEDII), 2010-2025[14]

Year	w1* GDP _n	w2* GDP growth _n	w3* GDP per capita _n	w4* Shadow Economy _n	w5* Hidden Economy _n	w6* Informal Economy _n	SEDII
2010	0.0000	0.1386	0.0000	0.0444	0.0313	0.0463	0.2606
2011	0.0047	0.1477	0.0028	0.0153	0.0313	0.0168	0.2186
2012	0.0092	0.1318	0.0056	0.0271	0.0500	0.0301	0.2538
2013	0.0145	0.1432	0.0087	0.0285	0.0062	0.0266	0.2277
2014	0.0209	0.1386	0.0124	0.0264	0.0000	0.0238	0.2222
2015	0.0277	0.1432	0.0161	0.0118	0.0313	0.0119	0.2420
2016	0.0344	0.1159	0.0198	0.0000	0.0250	0.0000	0.1951
2017	0.0479	0.0705	0.0273	0.0139	0.0688	0.0189	0.2473
2018	0.0693	0.0932	0.0391	0.0410	0.0750	0.0470	0.3645
2019	0.0906	0.1182	0.0504	0.0632	0.0438	0.0659	0.4321
2020	0.1051	0.0000	0.0574	0.0681	0.1000	0.0778	0.4084
2021	0.1317	0.1500	0.0708	0.0757	0.0563	0.0799	0.5643
2022	0.1624	0.1023	0.0857	0.0931	0.0438	0.0960	0.5833
2023	0.1999	0.1068	0.1035	0.0965	0.0188	0.0974	0.6230
2024	0.2465	0.1159	0.1254	0.0979	0.0125	0.0981	0.6963
2025	0.3000	0.1386	0.1500	0.1500	0.0125	0.1500	0.9011

The table presents the weighted components used to calculate the Sustainable Economic Development Integral Index (SEDII) for 2010-2025. Each normalized indicator was multiplied by its corresponding weight, GDP, GDP growth, GDP per capita, shadow economy, hidden economy and informal economy. The results show that the SEDII remained at a relatively low level during 2010-2018, fluctuating between 0.1951 and

0.3645, which reflects the combined effect of moderate economic development indicators and a high share of shadow and informal economic activity. From 2019 onward, the index began to improve steadily, reaching 0.4321 in 2019, 0.5643 in 2021 and 0.6963 in 2024. The highest value was recorded in 2025 at 0.9011, indicating a substantial improvement in sustainable economic development. Overall, the dynamics of the SEDII

suggest that the expansion of GDP and GDP per capita, together with the gradual reduction of shadow and

informal economic pressure, contributed positively to the strengthening of sustainable economic development.

Table-4

Indicator weights and normalization methodology for the sustainable economic development integral index (SEDII)[15]

Indicator	Weight	Direction	Normalization formula	Explanation
GDP at current prices	0.30	+	$Z = (x - \min) / (\max - \min)$	The main volume indicator of sustainable development; therefore, the highest weight was assigned
GDP growth rate	0.15	+	$Z = (x - \min) / (\max - \min)$	Reflects the dynamics of economic growth
GDP per capita	0.15	+	$Z = (x - \min) / (\max - \min)$	Indicates the quality of economic development
Share of the shadow economy	0.15	–	$Z = (\max - x) / (\max - \min)$	A decrease in the shadow economy share strengthens sustainable development
Share of the hidden economy	0.10	–	$Z = (\max - x) / (\max - \min)$	Hidden economic activity negatively affects the tax base and institutional efficiency
Total share of shadow and hidden economy	0.15	–	$Z = (\max - x) / (\max - \min)$	Represents the overall pressure of shadow and informal economic activity

The table describes the methodological basis for constructing the Sustainable Economic Development Integral Index (SEDII). The selected indicators were divided into positive and negative directions according to their impact on sustainable economic development. GDP at current prices, GDP growth rate and GDP per capita were treated as positive indicators because their growth reflects the expansion, dynamics and quality of economic development. In contrast, the shares of the shadow economy, hidden economy and their total share were treated as negative indicators, since an increase in these

variables weakens fiscal stability, reduces institutional transparency and limits the development of the formal sector. The highest weight was assigned to GDP at current prices, while the remaining weights were distributed among growth, welfare and shadow economy pressure indicators. This weighting and normalization approach makes it possible to combine indicators with different units of measurement into a single integral index and to assess the overall impact of shadow and hidden economic activity on sustainable development.

Table-5

Relationship between the sustainable economic development integral index, informal and hidden economy share, and GDP in Uzbekistan, 2010-2025[16]

Year	SEDII	Total share of informal and hidden economy, %	GDP, billion soums
2010	0.2606	41.7	88,102.4
2011	0.2186	45.9	115,627.8
2012	0.2538	44.0	142,333.0
2013	0.2277	44.5	173,201.5
2014	0.2222	44.9	210,998.3
2015	0.2420	46.6	250,544.6
2016	0.1951	48.3	290,213.4
2017	0.2473	45.6	369,612.8
2018	0.3645	41.6	494,814.8

2019	0.4321	38.9	620,083.2
2020	0.4084	37.2	705,076.5
2021	0.5643	36.9	861,170.8
2022	0.5833	34.6	1,041,877.9
2023	0.6230	34.4	1,261,806.0
2024	0.6963	34.3	1,535,431.7
2025	0.9011	26.9	1,849,650.0

The table demonstrates the relationship between the Sustainable Economic Development Integral Index (SEDII), the total share of the informal and hidden economy, and GDP in Uzbekistan during 2010-2025. The results show that GDP increased continuously from 88,102.4 billion soums in 2010 to 1,849,650.0 billion soums in 2025, while the total share of the informal and hidden economy declined from its highest level of 48.3 percent in 2016 to 26.9 percent in 2025. During the same period, the SEDII improved significantly, rising from 0.1951 in 2016 to 0.9011 in 2025. This trend indicates

that the reduction of informal and hidden economic activity was accompanied by the strengthening of sustainable economic development. In particular, the decline in the non-observed economy contributed to the expansion of the formal sector, improvement of fiscal transparency, growth of official GDP, and better institutional conditions for long-term economic development. Therefore, the table confirms that reducing the share of the informal and hidden economy is an important factor in increasing the sustainability and quality of economic growth.

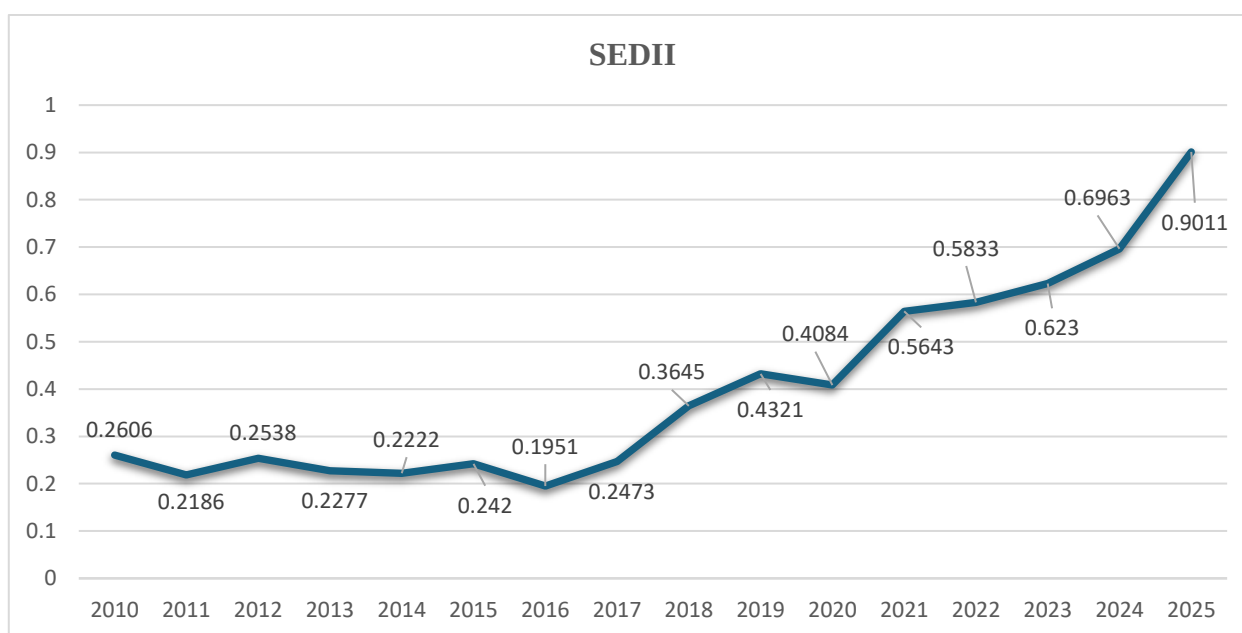


Figure-1. Dynamics of the sustainable economic development integral index (SEDII) in Uzbekistan, 2010-2025[17]

The figure illustrates the dynamics of the Sustainable Economic Development Integral Index (SEDII) in Uzbekistan during 2010-2025. The index remained at a low level in 2010-2017, fluctuating between 0.1951 and 0.2606, which indicates that sustainable development was constrained by relatively high informal and hidden economic activity during this period. From 2018 onward, the SEDII began to increase more steadily, reaching 0.4321 in 2019 and 0.5643 in 2021. A further

improvement was observed in 2023-2025, when the index rose from 0.6230 to 0.9011. This upward trend shows that the expansion of official GDP, growth in GDP per capita, and gradual reduction of shadow and informal economic pressure contributed to strengthening sustainable economic development. Overall, the figure confirms that the quality and stability of economic growth improved significantly in the later years of the observed period.

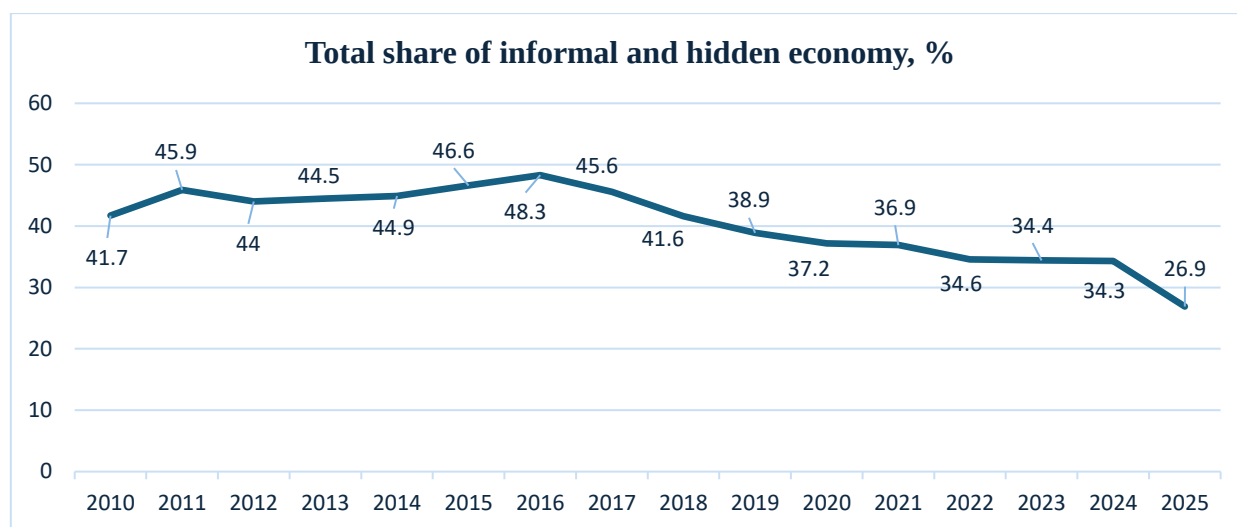


Figure-2. Dynamics of the Total Share of Informal and Hidden Economy in Uzbekistan, 2010-2025[18]

The figure shows the dynamics of the total share of the informal and hidden economy in Uzbekistan during 2010-2025. The indicator remained relatively high in the first half of the period, increasing from 41.7 percent in 2010 to its peak of 48.3 percent in 2016. This indicates that a significant part of economic activity was outside formal registration, taxation and institutional control during that period. After 2016, the total share of the informal and hidden economy began to decline steadily,

reaching 41.6 percent in 2018, 36.9 percent in 2021, 34.3 percent in 2024 and 26.9 percent in 2025. This downward trend suggests a gradual reduction in non-observed economic activity and reflects the strengthening of formal economic mechanisms, tax administration, digitalization and institutional transparency. Overall, the figure demonstrates that the reduction of informal and hidden economic activity has become an important factor supporting sustainable economic development.

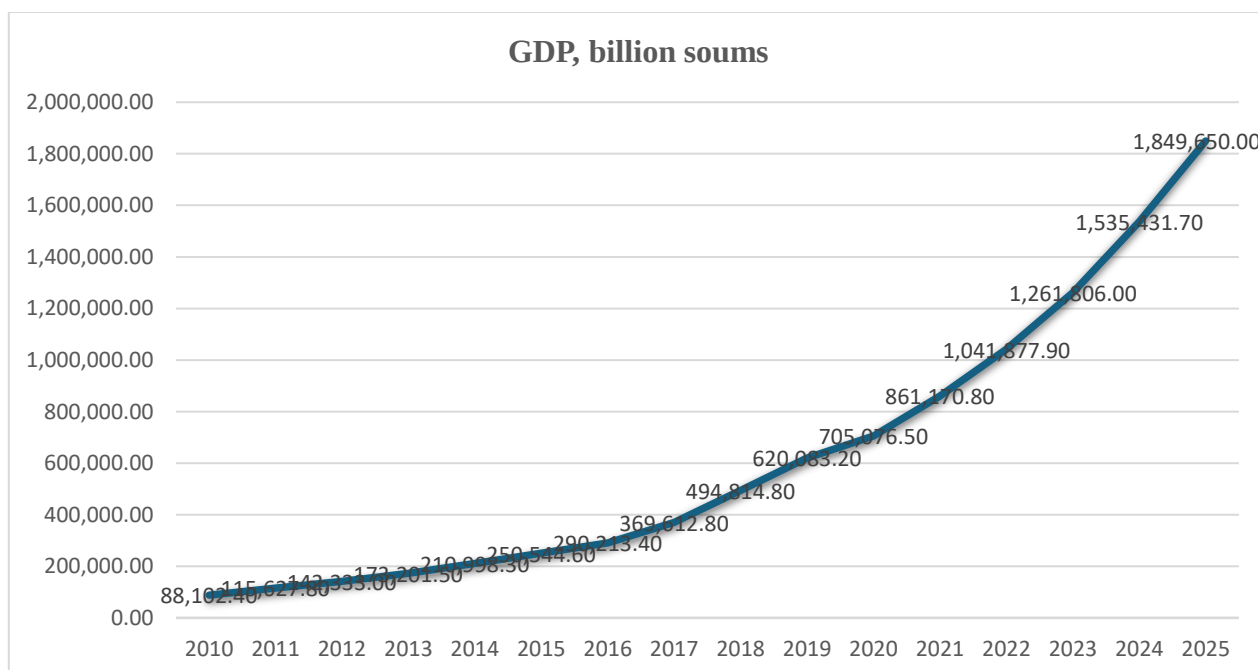


Figure-3. Dynamics of GDP at current prices in Uzbekistan, 2010-2025[19]

The figure presents the dynamics of Uzbekistan's GDP at current prices during 2010-2025. The data show a

continuous and rapid increase in GDP, rising from 88,102.4 billion soums in 2010 to 1,849,650.0 billion

soums in 2025. The growth became especially dynamic after 2017, reflecting the expansion of economic activity, structural reforms and the increasing scale of the official economy. In the context of this study, the upward trend in GDP is important because it indicates the strengthening of the formal economic base, while the simultaneous decline in the total share of the informal and hidden economy suggests that economic growth was gradually accompanied by improved transparency and broader formalization. Therefore, the figure confirms that GDP growth is one of the key positive components of the Sustainable Economic Development Integral Index.

Policy Recommendations

Based on the results of the Sustainable Economic Development Integral Index (SEDII), reducing the shadow and hidden economy should be considered one of the key priorities for strengthening sustainable economic development. First, it is necessary to expand the digitalization of economic transactions by increasing the use of electronic payments, online cash registers, electronic invoices and integrated tax information systems. This will help reduce cash-based hidden operations and improve the transparency of business activity. Second, tax administration should be improved not only through stronger control, but also through simplified tax procedures, lower compliance costs and incentives for small businesses to operate formally. Third, special attention should be paid to the formalization of employment, since informal employment reduces social protection, pension contributions and the reliability of labor market statistics. Fourth, the state should strengthen institutional transparency by improving data exchange between tax authorities, banks, customs, statistical agencies and local governments. Fifth, support mechanisms for small and medium-sized enterprises should be expanded, because excessive administrative barriers often push businesses into informal activity. Finally, the reduction of the shadow and hidden economy should be directly linked with sustainable development policy, as formalization increases budget revenues, improves investment attractiveness, strengthens fair competition and creates broader opportunities for inclusive economic growth. Therefore, decreasing the share of informal and hidden economic activity is not only a fiscal task, but also an important condition for improving the quality, stability and sustainability of national economic development.

5. Conclusion

The results of the study confirm that the shadow and hidden economy has a significant negative impact on sustainable economic development. The integral assessment based on selected indicators shows that sustainable development cannot be evaluated only through GDP growth, but should also consider the scale of informal and hidden economic activity, fiscal transparency, institutional efficiency and the quality of formal economic relations. In the case of Uzbekistan, GDP and GDP per capita increased steadily during 2010-2025, while the total share of the informal and hidden economy declined from its peak of 48.3 percent in 2016 to 26.9 percent in 2025. During the same period, the Sustainable Economic Development Integral Index rose from 0.1951 in 2016 to 0.9011 in 2025. This indicates that the reduction of non-observed economic activity was accompanied by the strengthening of formal economic growth, improved institutional transparency and higher development sustainability.

The findings show that the shadow and hidden economy weakens sustainable development through several channels, including the reduction of tax revenues, distortion of official statistics, limitation of formal employment, unequal competition and lower effectiveness of public policy. Therefore, reducing the share of the shadow and hidden economy should be considered not only a fiscal objective, but also a strategic condition for long-term sustainable development. The proposed integral assessment approach provides a useful methodological tool for monitoring the relationship between hidden economic activity and sustainable development. In practical terms, the results suggest that digitalization of economic transactions, improvement of tax administration, formalization of employment, simplification of business procedures and strengthening of institutional coordination are essential measures for reducing the shadow economy and increasing the quality, stability and inclusiveness of economic growth.

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