India's Progress towards SDG 11 through the Smart Cities Mission (SCM): A Comparative Study of Tamil Nadu, Maharashtra, and Uttar Pradesh

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***Abstract*—In India, urban areas represent engines of economic growth and structural transformation. Government projections for urban India in 2030 indicate an increase to 40%, which will be close to 75% of GDP. In this context, the government of India, launched the Smart Cities Mission (SCM) in 2015, as a flagship urban renewal programme aligned with Sustainable Development Goal (SDG) 11, which aims to make cities inclusive, safe, resilient, and sustainable. This paper analyses the performance of the Smart Cities mission through a conceptual framework that links SDG-11 outcomes to the growing role of Global Capability Centres (GCCs). The study shows a comparative assessment of Smart cities - Tamil Nadu, Maharashtra, and Uttar Pradesh, which represent three efficient yet distinct urban development trajectories, using secondary data from Niti Aayog and various government sources to evaluate progress in the three cities towards the SDG goals.**

***Index Terms*—Smart Cities, SDG-11, Global Capability Centres**

I. INTRODUCTION

The Smart Cities Mission (SCM) was launched in 2015 to provide access towards adequate housing, sanitation, transport and environmental services. Through innovative city initiatives and a policy framework, it has recognised the challenges of rapid urbanisation and aligned its urban development agenda with the United Nations Sustainable Development Goals (SDGs), particularly SDG-11 which aims to make cities and Human settlements inclusive, Safe, resilient, and sustainable.

This paper shows how Smart city interventions have influenced urban sustainability outcomes in the states of Tamil Nadu, Maharashtra, and Uttar

Pradesh. All three states are front-runners in achieving the SDG goals, but represent different paths to achieving them. India's overall performance under SDG-11, according to the SDG India Index, has increased from 39 in 2018 to 83 in 2023-24, reflecting significant improvements in urban sanitation and service delivery.

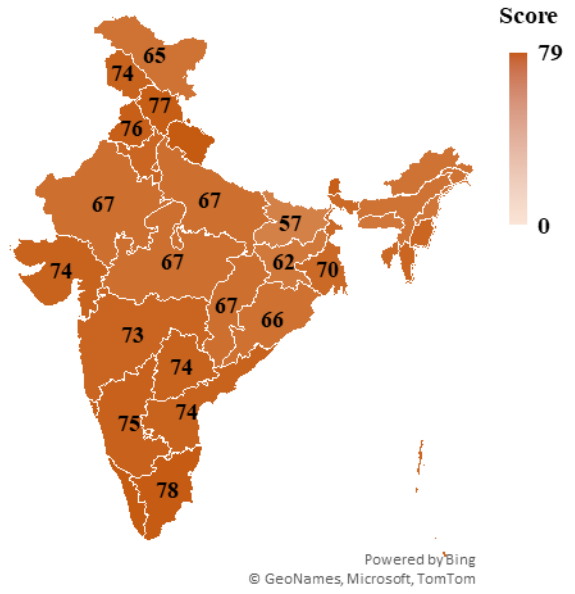

Figure 1: Performance of States and Union Territories in achieving SDG 11 (2023-24)
Source: SDG India Index, NITI Aayog

Figure 2: India's Achievement in SDG-11
Source: Niti Aayog

The SCM scheme has made substantial progress: 7,555 projects—94% of the total 8,067—have been completed, amounting to ₹1,51,361 crore. 512 projects worth ₹13,043 crore are in the advanced stages of implementation. This amounts to an overall 8,067 multi-sectoral projects valued at ₹1.64 lakh crore. Also, 78 cities are equipped with an integrated command and control centre, 721 projects completed for smart roads, 531 projects completed for waste management, and 226 projects completed under Public-Private Partnership.

II. REVIEW OF LITERATURE

Tamil Nadu leads India's SCM with 11 selected cities, including Chennai, Coimbatore, Madurai, and Tiruchirappalli (Meenakshi & Kiruthika, 2025). A case study of Madurai demonstrates progress in achieving SDG goals through citizen science monitoring of water and sanitation targets (Kumaravel et al., 2025). Ganesh et al. (2024) assessed waste management across 11 cities, finding collection efficiencies ranging from 80% to 100%, while segregation rates varied significantly, from below 50% to 100%. The study identified poor infrastructure, limited public awareness, and financial limitations as significant constraints. Meenakshi & Kiruthika (2025) discussed innovative financing mechanisms such as green bonds, social impact bonds, and blended finance, but noted that greater policy support and standardised measurement frameworks are needed to scale investments.

Bhandarkar et al. (2025) examined six major cities in Maharashtra under SCM, identified improvements in smart mobility, digital governance, waste-to-energy projects, and water reuse systems, with an emphasis on decentralised waste management and smart metering as indicators for achieving SDG 11. In Nagpur specifically, Kisi et al. (2023) found that sewage treatment systems generated more revenue compared to other analysed cities, though garbage collection showed limited improvement.

In Uttar Pradesh, Safiullah et al. (2023) examined Lucknow's performance in the Ease of Living Index. They noted that it achieved a strong ranking and demonstrated multidisciplinary aspects in its development strategy. Mishra et al. (2017) assessed Allahabad's readiness for smart city transformation, identifying potential but noting that complete overhauling is required in many areas.

III. OBJECTIVES OF THE STUDY

- To study the performance of states – Tamil Nadu, Maharashtra and Uttar Pradesh in SDG-11
- To understand the Funding patterns and utilisation of funds for SCM in these states

IV. HYPOTHESIS OF THE STUDY

A. There is an increasing trend in central fund releases over the 5 years.
B. There is a significant difference in fund utilisation rates among Tamil Nadu, Uttar Pradesh, and Maharashtra.

V. SDG-11, SMART CITIES MISSION(SCM) AND GLOBAL CAPABILITY CENTRES(GCCs): CONCEPTUAL FRAMEWORK

SDG 11 and the SCM together form the cornerstone of India's contemporary urban development strategy. While SDG 11 provides a global outlook on inclusive, safe, resilient and sustainable cities, the SCM serves as India's means to operationalise these objectives at the city level. In recent years, an essential and emerging dimension of this integration has been the role of GCCs in shaping smart, economically vibrant, and globally connected urban ecosystems.

Smart Cities are centres of economic activity, innovation, and employment generation. The development of high-quality urban infrastructure, reliable utilities, digital connectivity, and improved liveability under SCM has enhanced Indian cities as Global Capability Centres (GCCs).

The growth of GCCs contributes significantly to SDG-11 in several ways:

- By generating high-quality skilled employment opportunities.
- Their presence enables cities to maintain high service standards and adopt innovative infrastructure solutions.
- GCCs in collaborations with urban local bodies reinforces data driven urban planning
- Improved Urban Living conditions, which contribute directly to SDG-11 targets related to liability and inclusiveness.

India is a global hub for GCCs, with 1700 Global capacity centres set up in tier-one metropolitan cities, accounting for approximately 50% of the world's GCC footprint. This opportunity has further enhanced skill development and reinforced the need for an efficient and robust digital infrastructure and policy framework, such as the SCM, which has accelerated the digitalisation of urban governance and service delivery across states like Tamil Nadu, Maharashtra, Uttar Pradesh, and Karnataka.

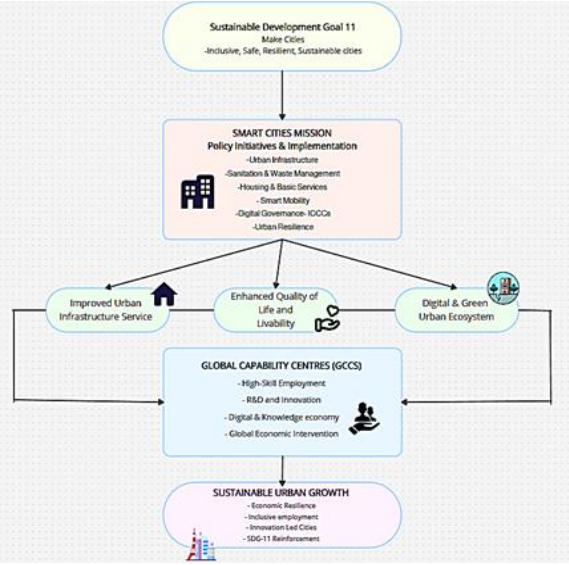

Figure 3: Conceptual framework of SCM, GCC and SDG-11

Source: Constructed by the authors

Figure 3 shows the link between the SCM and GCCs in achieving SDG-11. Improved urban infrastructure and livability create favourable conditions for GCC, which require high-quality physical, digital, and social infrastructure. In this way, GCCs strengthen cities economically by generating skilled employment, fostering innovation, and integrating them into global value chains.

VI. ANALYSIS 3-TIER PERFORMANCE OF SDG-11

The study focuses on a 3-tier performance analysis of the states Tamil Nadu, Maharashtra and Uttar Pradesh. The selection of these states for the study is based on their strategic ideas, diversity in urbanisation patterns, and contrasting performance under the SDG-11 and the SCM. Together, these three states provide a comprehensive representation of India's Urban development landscape.

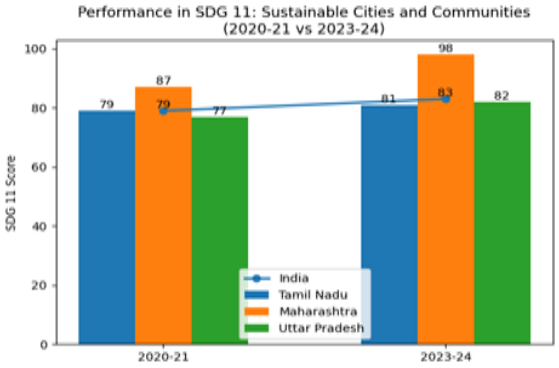

Figure 4: Overall Scores between States and National Average

Source: Computed by the authors from NITI Aayog

Figure 4 shows that the states of Tamil Nadu, Maharashtra, and Uttar Pradesh fall into the performing category in achieving the SDG goals. Through the SCM Scheme, the three states reflecting distinct models of urban growth in India, performance has improved over the years, with Tamil Nadu improving from 79 in 2021 to 81 in 2024, Maharashtra from 87 to 98, and Uttar Pradesh from 77 to 82.

Tamil Nadu represents a circular economy growth with infrastructure as the primary focus and strong municipal governance. Maharashtra represents metropolitan-driven urbanisation, with megacities like Mumbai and Pune. Uttar Pradesh, on the other hand, illustrates scale-based and rapidly evolving urbanisation, where improvements are being driven by mission-mode governance across a vast number of urban local bodies.

Table 1: Comparison of SDG-11 indicators with State Average and National Average

Indicators for SDG 11	National Avg.	Tamil Nadu	Maharashtra	Uttar Pradesh
Composite Goal 11 score	83	Front Runner	Performer	Fastest Mover
Sewage Generated (MLD)	72,368	6,422	9,107	8,263
Sewage Treatment Ratio (%)	50.67	44	47	38
Solid Waste Processed (%)	78.46	88	81	75
Door-to-Door Collection (%)	97.00	99	98	95
Road Safety (Deaths/100k)	13	23	15	11

Source: SDG India Index and State SDG Reports, NITI Aayog

Table 1 highlights the comparison of indicators of SDG-11 with the state average and the National average for the year 2023-24

A. Tamil Nadu - Front Runner: Infrastructure Growth and Circular Economy

Tamil Nadu has nearly 50% of its population living in urban areas. With the second-highest number of Smart Cities in India, institutional reforms such as the Chennai Unified Metropolitan Transport Authority (CUMTA) and the Third Master Plan for the Chennai Metropolitan Area (2027-46) reflect an integrated planning approach. Based on data from the State SDG report and the NITI Aayog report, the following can be interpreted in terms of strengths and weaknesses.

Strengths in Tamil Nadu are a Solid waste processing rate of approximately 88%, which is well above the national average, Universal door-door waste collection, and housing coverage is nearly 100% and Leadership in the reuse of treated wastewater, with about 25% of wastewater reused for industrial purposes, which is the highest among the three states. Challenges are Sewage treatment ratio remains at around 44% and the High Road accident fatality rate, reflecting high vehicle density and congestion

B. Maharashtra - Metropolitan Governance Hub

Maharashtra hosts some of India's most significant urban agglomerations, including Mumbai and Pune, and generates the highest volume of municipal waste and sewage. Maharashtra's innovative city initiatives emphasise digital governance, traffic management and emergency response systems.

Strengths include accounting for the largest share of installed sewage treatment capacity in India, achieving a Solid waste processing rate of about 81%, and using Advanced Integrated Command and Control Centres (ICCCs) for urban governance. Challenges include untreated sewage at 47% and Persistent challenges in slum redevelopment despite progress under Pradhan Mantri Awas Yojana – Urban (PMAY-U).

C. Uttar Pradesh - Scale and Rapid Improvement

Uttar Pradesh has emerged as the fastest mover in SDG-11 performance, recording significant improvement in its index score since 2018. It is also essential to note that Uttar Pradesh has received substantial central funding under Namami Gange and Amrut 2.0 to address river pollution and the deficit in sewage infrastructure.

Strengths are the Rapid expansion of Infrastructure under the Swachh Bharat Abhiyan, Door-to-door waste collection coverage of approximately 95% and Large-scale housing delivery under PMAY-U. Challenges include a Sewage treatment ratio of only 38%, below the national average, and a Waste processing rate of around 75%, indicating a need to shift the focus from collection to treatment.

D. Smart Technology

Tamil Nadu focuses on Smart water management using IoT sensors in cities such as Chennai and Coimbatore to track water leaks and monitor Sewage Treatment Plants (STPs) in real time. Maharashtra leads in Integrated command control centres (ICCCs). Cities like Pune and Mumbai use innovative technologies to manage traffic and GPS-enabled systems for waste-collection trucks and emergency response. It is bright and waste-to-energy ideas that enable them to achieve sustainable development goals smoothly. Uttar Pradesh focuses on Smart Sanitation. In Varanasi and Lucknow, the focus is on "Smart Waste Bins" and automated sweeping to handle high-density pilgrim and tourist footfall.

The Ministry of Housing and Urban Affairs (MoHUA) awards the top-performing cities and states under the SCM for innovation and sustainable urban development (India Smart cities award). Tamil Nadu has consistently been one of the top-performing states.

The state has received the Best State Award twice, followed by Uttar Pradesh in third place. Tamil Nadu has 11 cities as part of the SCM which is also the highest number of smart cities in India. With Chennai and Coimbatore cited as the" lighthouse models" for the SCM, and Coimbatore receiving the first prize for lake restoration, model roads, and Finance. The state stands as a frontrunner in development. Other cities of the states have also been leading in ensuring SCM, for instance the Thanjavur Corporation won third prize for projects on cultural development and the preservation of the town's history. Under digitalization Tuticorin Corporation won third place in the school digitisation competition. These recognitions and awards show how the states progress in SDG -11 has achieved.

Uttar Pradesh ranks third in the SCM award, with Varanasi receiving an award for its innovative water program. Maharashtra has not been in the top-performing states, but has received awards under Mobility solutions and safety and security.

VII. RESULTS & DISCUSSION

Table 2 - Annual GOI Fund Releases per State

State	2019-20	2020-21	2021-22	2022-23	2023-24	Total	YoY Trend
Tamil Nadu	302	791	826	1,384	43	3,346	VOLATILE
Uttar Pradesh	86	296	1,132	1,225	833	3,572	PARTIAL ↑
Maharashtra	119	294	469	612	760	2,254	STEADY ↑
Aggregate	507	1,381	2,427	3,221	1,636	9,172	NON-SIGNIFICANT

All values in ₹ Lakhs. Aggregate = sum of all three state-level releases. YoY – Year over Year

Source: Computed by the authors from secondary data

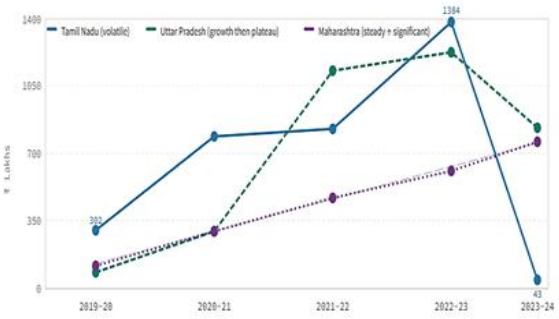

Figure 5 - Annual Fund Releases by State (2019-20 to 2023-24)

Source: Computed by the authors from secondary data

The data shows Tamil Nadu exhibits a highly volatile trend, with a sharp rise from 302 (2019–20) to a peak of 1,384 (2022–23), followed by a drastic decline to 43 in 2023–24. Uttar Pradesh shows an overall upward trend, rising substantially from 86 to 1,225 by 2022–23, though declining moderately to 833 in the final year. Maharashtra shows a consistent, steady increase across all years, rising from 119 to 760. At the aggregate level, totals increased steadily until 2022–23 (3,221) but dropped considerably in 2023–24 (1,636).

VIII. HYPOTHESIS TESTING

A. Trends in Central Fund Releases over the 5 years

- H_0: There is no increasing trend in central fund releases over the 5 years.
- H_1: There is an increasing trend in central fund releases over the 5 years.

Table 3 – Mann-Kendall Trend Test Summary

State / Level	S Statistic	Var (S)	Z Score	p-value	Kendall's τ	Sen's Slope	Decision
Tamil Nadu	2	16.67	0.245	0.807	0.2	148.5	NOT SIG.
Uttar Pradesh	6	16.67	1.225	0.221	0.6	198.38	NOT SIG.
Maharashtra	10	16.67	2.205	0.028	1	159.62	SIG.
Aggregate	6	16.67	1.225	0.221	0.6	834	NOT SIG.

S = Kendall's concordance statistic. Positive S = upward trend. τ = 1.000 for Maharashtra indicates a perfect monotonic increase. Sen's Slope = median pairwise slope (₹ Lakhs/year). Two-tailed p-value; one-tailed would-be half (Maharashtra one-tailed p = .014).

Source: Computed by the authors from secondary data

Interpretation

The null hypothesis is accepted for the states of Tamil Nadu and Uttar Pradesh, stating that there is no significant difference in the distribution of central funds over the last 5 years. For the state of Maharashtra, the null hypothesis is rejected as there is a statistically significant monotonic upward trend.

B. Difference In Fund Utilisation Rates Among Tamil Nadu, Uttar Pradesh, And Maharashtra

- H_0: There is no significant difference in fund utilisation rates among Tamil Nadu, Uttar Pradesh, and Maharashtra.
- H_1: There is a significant difference in fund utilisation rates among Tamil Nadu, Uttar Pradesh, and Maharashtra.

Table 4 - One-Way ANOVA: Utilisation Rate (%) by State

Source	Sum of Squares	Df	Mean Square	F	Sig. (p)	Decision
Between Groups	17.634	2	8.817	0.809	0.454	Not Significant
Within Groups (Error)	348.413	32	10.888			
Total	366.047	34				

F critical value at α=.05, df(2,32) = 3.295. Obtained F (0.809) < F-critical (3.295). Significance: p = .454 > .05.

Table 5 - Post-Hoc Pairwise Comparisons (Bonferroni Adjusted α = .0167)

Group (I)	Group (J)	Mean Difference (I–J)	t-value	Sig. (2-tailed)	Decision
Tamil Nadu	Uttar Pradesh	−0.978	−0.590	0.561	Not Significant
Tamil Nadu	Maharashtra	−1.950	−1.128	0.273	Not Significant
Uttar Pradesh	Maharashtra	−0.972	−1.044	0.308	Not Significant

All pairwise comparisons are non-significant after Bonferroni correction. No post-hoc differences detected.

Table 6 - Kruskal–Wallis Test

Variable	Chi-Square (H)	Df	Asymp. Sig. (p)	Decision
Utilisation Rate (%)	1.852	2	0.396	Not Significant

Kruskal-Wallis H = 1.852, p = .396 > .05. Non-parametric result confirms ANOVA finding.

Source: Computed by the authors from secondary data

Interpretation

A one-way ANOVA examined whether fund utilisation rates (%) differed significantly across Tamil Nadu, Uttar Pradesh and Maharashtra. The analysis revealed no significant difference in

utilisation rate. Therefore, the null hypothesis (H_0) is accepted.

IX. CONCLUSION

India has demonstrated substantial progress towards achieving SDG-11, particularly after the launch of primary urban-focused missions since 2015. The government of India has systematically aligned its national urban development strategies with SDG-11 targets, integrating them into flagship programmes such as the SCM, Swachh Bharat Mission-Urban (SBM-U), Atal Mission for Rejuvenation and Urban Transformation (AMRUT), and PMAY-U. The overall improvement in score also indicates a strong upward trajectory reflecting enhanced urban service delivery, improved waste management systems, and progress in housing and basic infrastructure across urban local bodies. Sanitation, housing and waste collection have also shown remarkable improvements. The challenges persist in the sewage treatment, road safety and environmental sustainability. To fully realise the benefits of SCM, a more integrated, technology-driven urban governance is needed. It also highlights the need for the next phase of reforms to focus on infrastructure depth, institutional capacity, and long-term urban resilience.

REFERENCES

[1] S. Bhandarkar and V. Bagul, “From vision to implementation: Evaluating India’s Smart Cities Mission and citizen perspectives in the state of Maharashtra,” International Journal for

Multidisciplinary Research, vol. 7, no. 6, 2025, doi: 10.36948/ijfmr.2025.v07i06.61373.

[2] Census of India, Primary Census Abstract. New Delhi, India: Government of India, 2011. [Online]. Available: https://censusindia.gov.in

[3] Chennai Metropolitan Development Authority, Third Master Plan for Chennai Metropolitan Area. Chennai, India: CMDA, 2019. [Online]. Available: https://www.cmdachennai.gov.in

[4] "From policy to prosperity: GCCs leading India's growth journey," Press Information Bureau, n.d. [Online]. Available: https://www.pib.gov.in/PressReleasePage.aspx?PRID=2202046

[5] Government of India, NITI Aayog-SDG India Index and Dashboard. [Online]. Available: https://sdgindiaindex.niti.gov.in/#/ranking

[6] Government of Tamil Nadu, Tamil Nadu's Vision for Sustainable Development Goals Report, 2024. [Online]. Available: https://spc.tn.gov.in/wp-content/uploads/TN_SDG_VISION.pdf

[7] Government of Uttar Pradesh, Sustainable Development Goals, Planning Department. [Online]. Available: https://epariyojana.up.gov.in/sdg/

[8] K. P. Kisi, K. Shrestha, R. Kayastha, and U. Khan, "Comparative analysis of project-level indicators for smart cities," Civil Engineering and Architecture, vol. 11, no. 5, pp. 2559–2571, 2023, doi: 10.13189/cea.2023.110523.

[9] P. Kumaravel, R. Velkennedy, and V. Baskaran, "Community wellspring: Harnessing citizen science for Sustainable Development Goal 6 in a smart city," Local Environment, vol. 30, no. 11, pp. 1349–1367, 2025, doi: 10.1080/13549839.2025.2471006.

[10] Maharashtra State Data Bank, Government of Maharashtra. [Online]. Available: https://mahasdb.maharashtra.gov.in/SDG/

[11] K. K. Maurya and A. Biswas, "Performance assessment of governance in Indian smart city development," Smart and Sustainable Built Environment, vol. 10, no. 4, p. 653, 2020, doi: 10.1108/SASBE-04-2019-0045.

[12] N. S. Meenakshi and K. Kiruthika, "Impact investing: Financing sustainability in smart cities in Tamil Nadu," International Journal on Science and Technology, vol. 16, no. 2, 2025, doi: 10.71097/ijsat.v16.i2.6424.

[13] A. K. Mishra, A. A. Sen, and A. Kumar, "Exploring potentials and challenges in making smart cities in India: A case study of Allahabad City, Uttar Pradesh," in Springer Nature Link, pp. 123–142, 2017, doi: 10.1007/978-3-319-47145-7_8.

[14] T. Singh Parishad, "Analysing and rating smart city development in India," Journal of Civil Engineering and Environmental Technology, vol. 1, no. 6, pp. 54–59, 2014.

[15] PMAY-Urban. [Online]. Available: https://pmay-urban.gov.in/infographics

[16] Safiullah and S. Kumar, "Review of performance indicators of smart cities in India–Ease of Living Index: A case of Lucknow Smart City," Sustainability, Agri, Food and Environmental Research, vol. 11, 2023, doi: 10.7770/safer.v11i1.2983.

[17] Sustainable Development Annual Report, 2023. [Online]. Available: https://sdgindiaindex.niti.gov.in/#/download

[18] P. Varghese, "Exploring other concepts of smart-cities within the urbanising Indian context," Procedia Technology, vol. 24, pp. 1858–1867, 2016.

[19] M. Ahmed and E. Araral, "Water governance in India: Evidence on water law, policy, and administration from eight Indian states," Water, vol. 11, no. 10, p. 2071, 2019, doi: 10.3390/w11102071.

[20] KPMG, Sustainable Development Goals (SDGs): Leveraging CSR to Achieve SDGs. 2017. [Online]. Available: https://assets.kpmg.com/content/dam/kpmg/in/pdf/2017/12/SDG_New_Final_Web.pdf

[21] New Horizon, vol. 2, no. 2, 2024. [Online]. Available: https://sdgknowledgehub.undp.org.in/wp-content/uploads/2025/02/UNDP-Newsletter_Vol-2_Issue2.pdf

[22] R. Xiao, J. Deng, Y. Zhou, and M. Chen, "Analyzing contemporary trends in sustainable finance and ESG investment," Law and Economy, vol. 2, no. 11, pp. 44–52, 2023, doi: 10.56397/le.2023.11.06.