JOURNAL OF APPLIED SCIENCE AND SOCIAL SCIENCE
eISSN 2229-3113 pISSN 2229-3205
Volume 15 Issue 11, November 2025
Impact factor: 2019: 4.679 2020: 5.015 2021: 5.436, 2022: 5.242, 2023: 6.995, 2024 7.75

CIRCULAR ECONOMY IN URBAN INDUSTRIAL SYSTEMS: A CASE STUDY OF TASHKENT

Kamoliddin Nuriddinov

Lecturer and Researcher at Tashkent State University of Economics,

Tashkent, Uzbekistan. Email: kamoliddin.nuriddinov@tsue.uz

This article examines how circular economy (CE) principles can be integrated into Tashkent's urban-industrial systems to support Uzbekistan's green economy transition. It outlines the theoretical foundations of CE—designing out waste, keeping materials in use, and regenerating natural systems—and situates them within the city's industrial context. Drawing on secondary data from government policy documents, international organizations, and scholarly literature, the study identifies key barriers such as outdated technologies, weak regulatory enforcement, and limited green financing. Comparative analysis reveals that Uzbekistan's recycling rates remain below 10%, lagging far behind OECD averages. The author argues that Tashkent can advance its CE transition through innovation, public–private partnerships, and enhanced regulatory frameworks, including extended producer responsibility and green investment mechanisms. The paper contributes to scarce empirical literature on circular economy adoption in Central Asia and proposes a practical framework for aligning industrial management with sustainable development goals.

Keywords: circular economy; urban industrial systems; resource conservation; sustainable development; green economy transition; Tashkent.

1. Introduction

The global shift from a linear "take–make–waste" model to a circular economy is increasingly viewed as essential for decoupling growth from the consumption of finite resources. In a circular economy, products and materials are kept in circulation (via maintenance, reuse, remanufacture, and recycling) and natural systems are regenerated, rather than depleted. Yet despite the momentum, global circularity remains low and has been declining in recent years (Ellen MacArthur Foundation, n.d.; Circle Economy, 2024).

Cities sit at the heart of this challenge and opportunity. Urban areas concentrate industry, infrastructure and demand; they consume around three-quarters of global primary energy and are responsible for roughly half or more of greenhouse-gas emissions. Circular-economy policies tailored to cities—designing out waste and pollution, keeping products and materials in use, and regenerating natural systems—offer a practical lever to reduce environmental pressures while supporting competitiveness and jobs (UN-Habitat, n.d.; OECD, 2020).

In Uzbekistan, Tashkent is the primary urban-industrial hub and a focal point for the country's

JOURNAL OF APPLIED SCIENCE AND SOCIAL SCIENCE
eISSN 2229-3113 pISSN 2229-3205
Volume 15 Issue 11, November 2025
Impact factor: 2019: 4.679 2020: 5.015 2021: 5.436, 2022: 5.242, 2023: 6.995, 2024 7.75

green transition. The government's *Strategy for the Transition to a Green Economy, 2019–2030 (PP-4477)* sets targets including improved energy efficiency and greater uptake of clean technologies, while the city has been the object of multi-year modernization efforts in solid-waste management supported by international partners (Republic of Uzbekistan, 2019; World Bank, 2013). Together, these policy and investment signals create a timely context to examine how circular-economy principles can be embedded in Tashkent's urban-industrial systems.

Against this backdrop, the paper (i) situates circular-economy concepts within an urban Central Asian setting, (ii) identifies barriers and opportunities for adoption in Tashkent's industrial base, and (iii) proposes a practical framework aligning industrial management systems with circular strategies relevant to policymakers and managers.

2. Literature Review

2.1. Circular economy principles in industrial systems

The circular economy (CE) offers a framework for shifting away from the linear "take–make–dispose" model toward closed-loop processes where products, components, and materials retain their highest utility for as long as possible. Core strategies include eco-design, industrial symbiosis, remanufacturing, and recycling, which collectively aim to minimize waste and reduce reliance on virgin resources (Geissdoerfer et al., 2017). Within industrial systems, CE principles extend beyond waste management into production planning, supply chain coordination, and innovation in materials science (Kirchherr et al., 2018). For emerging economies, integrating CE into industrial management can simultaneously support competitiveness, reduce environmental pressures, and contribute to global climate targets (Korhonen, Honkasalo, & Seppälä, 2018).

2.2. Resource conservation in urban contexts

Urban areas account for more than 70% of global resource use and waste generation, making them critical arenas for implementing CE strategies (UN-Habitat, 2020). Cities concentrate both industrial activities and consumption patterns, producing challenges such as high energy demand, solid waste accumulation, and air pollution. Resource conservation in urban-industrial systems often involves improving energy efficiency, reusing construction and demolition materials, and valorizing industrial by-products for secondary use (OECD, 2020). In Tashkent, rapid urbanization has placed pressure on energy infrastructure and waste systems, highlighting the need for conservation-oriented industrial practices and municipal partnerships. Localized measures, such as modernizing waste sorting facilities and promoting eco-innovation among industrial enterprises, remain underdeveloped compared to global best practices.

2.3. Policy frameworks for circular economy (global and regional)

Globally, the European Union has been a leader in CE adoption through its *Circular Economy Action Plan (2020)*, which emphasizes eco-design, extended producer responsibility, and sector-

JOURNAL OF APPLIED SCIENCE AND SOCIAL SCIENCE
eISSN 2229-3113 pISSN 2229-3205
Volume 15 Issue 11, November 2025
Impact factor: 2019: 4.679 2020: 5.015 2021: 5.436, 2022: 5.242, 2023: 6.995, 2024 7.75

specific initiatives in plastics, construction, and textiles (European Commission, 2020). In Asia, countries such as China and Japan have introduced CE frameworks linking resource efficiency to industrial upgrading (Geng & Doberstein, 2008). Uzbekistan has committed to CE-related reforms under its *Strategy for the Transition to a Green Economy (2019–2030)*, which emphasizes renewable energy, waste reduction, and industrial modernization (Republic of Uzbekistan, 2019). However, regional implementation remains uneven, with limited integration of CE into industrial management practices at the city level.

2.4. Gaps in existing studies and the relevance for Tashkent

While CE research has expanded globally, most studies focus on developed economies or large emerging markets such as China and India (Kirchherr et al., 2017; Kalmykova, Sadagopan, & Rosado, 2018). Few works address Central Asia, and empirical studies on Uzbekistan are especially scarce. Tashkent, as the nation's industrial and economic hub, faces unique challenges including outdated industrial infrastructure, inefficient energy systems, and limited waste processing facilities. The absence of localized empirical research creates a gap in understanding how CE principles can be effectively adapted to urban-industrial systems in Uzbekistan. This paper addresses this gap by synthesizing global lessons and applying them to Tashkent's context, thereby providing both theoretical and policy-relevant contributions. **Table 1** presents a comparative review of global, regional, and local studies on circular economy in industrial systems. The evidence shows that while global and sector-specific insights are abundant, city-level applications in Uzbekistan, and particularly in Tashkent, remain underexplored.

Authors / Year	Research Focus / Context	Methodology	Key Findings	Limitations / Gaps
Dennison et al. (2024)	CE integration in manufacturing / industrial practices	Literature review / conceptual synthesis	Identified pathways for CE in manufacturing (waste valorization, closed loops) and key enablers (policy, technology) (Dennison et al., 2024)	Mostly global; little context on small or urban systems; limited empirical data in emerging economies

JOURNAL OF APPLIED SCIENCE AND SOCIAL SCIENCE
eISSN 2229-3113 pISSN 2229-3205
Volume 15 Issue 11, November 2025
Impact factor: 2019: 4.679 2020: 5.015 2021: 5.436, 2022: 5.242, 2023: 6.995, 2024 7.75

Despeisse et al. (2022)	Eco-efficiency and CE in industrial systems	Case studies + qualitative analysis	Showed industrial process redesign and resource efficiency are central to circular transitions (Despeisse et al., 2022)	Limited geographic breadth (mostly advanced economies); weak urban focus
Nikolakis et al. (2024)	Quantitative method for assessing CE strategies	Method development, simulation / decision model	Developed a methodology to evaluate CE strategies in manufacturing systems (Nikolakis et al., 2024)	Requires data-rich settings; not tested in low-resource / urban industrial settings
Zhang et al. (2025)	Triple-level CE design (materials / products / services)	Mixed method: literature review + case studies / design workshop	Proposed hierarchical CE model integrating design perspectives with measurable criteria (Zhang et al., 2025)	More theoretical; limited large-scale industrial empirical validation
Georgescu et al. (2025)	Drivers of recycling, resource efficiency, investment in CE	Empirical (EU-region data analysis)	Found strong links between private investment, resource efficiency and CE adoption; also regional disparities (Georgescu et al., 2025)	Focused on EU / developed economies; limited application to urban/industrial systems in emerging regions
Karimov (2023)	CE adoption in SMEs in Uzbekistan (rural context)	Survey / qualitative mixed method	SMEs in Uzbekistan show low awareness; major barriers are financial, knowledge, organizational (Karimov, 2023)	Rural / SME-level focus; not urban industrial or city-scale; limited generalizability to Tashkent industrial systems

World Bank (2024)	CE opportunities in Central Asia (incl. Uzbekistan)	Policy / sectoral analysis	Highlights CE in agri-food, construction chains; identifies enabling policy frameworks and investment levers (World Bank, 2024)	Macro / sector reports, not detailed city-level or industrial management systems analysis
SWITCH-Asia (2022)	CE in Uzbekistan's textile / garment industry	Sectoral study, data & case examples	Explores sustainable production and waste reuse in Uzbekistan's textile sector (SWITCH-Asia, 2022)	Sectoral and specific; not general industrial systems across Tashkent

Table 1. *Comparative Review of Previous Studies on Circular Economy and Industrial Systems*[1]

Methodology

3.1 Case study approach: Why Tashkent

This study adopts a case study approach, focusing on Tashkent as Uzbekistan's primary industrial and economic hub. The city concentrates a significant share of the country's manufacturing, construction, and service industries, which makes it highly representative of urban-industrial dynamics in Central Asia. Tashkent also faces challenges of rapid urbanization, outdated infrastructure, inefficient energy systems, and rising levels of municipal and industrial waste. These characteristics, combined with the government's commitment under the *Strategy for the Transition to a Green Economy (2019–2030)*, make Tashkent an appropriate case to investigate the application of circular economy (CE) principles to urban-industrial systems.

3.2 Data sources

The study relies on secondary data sources to build its analysis. These include:

- **Government policy documents** such as the *Green Economy Strategy 2030* and Ministry of Ecology and Natural Resources reports;
- **Industrial statistics** from the State Statistics Committee of Uzbekistan, World Bank development projects, and OECD databases;
- **Scholarly literature** from peer-reviewed journals on CE, resource conservation, and industrial management systems.

[1] **Note:** *Table 1 is compiled by the author from existing studies and adapted through the author's own interpretation.*

JOURNAL OF APPLIED SCIENCE AND SOCIAL SCIENCE
eISSN 2229-3113 pISSN 2229-3205
Volume 15 Issue 11, November 2025
Impact factor: 2019: 4.679 2020: 5.015 2021: 5.436, 2022: 5.242, 2023: 6.995, 2024 7.75

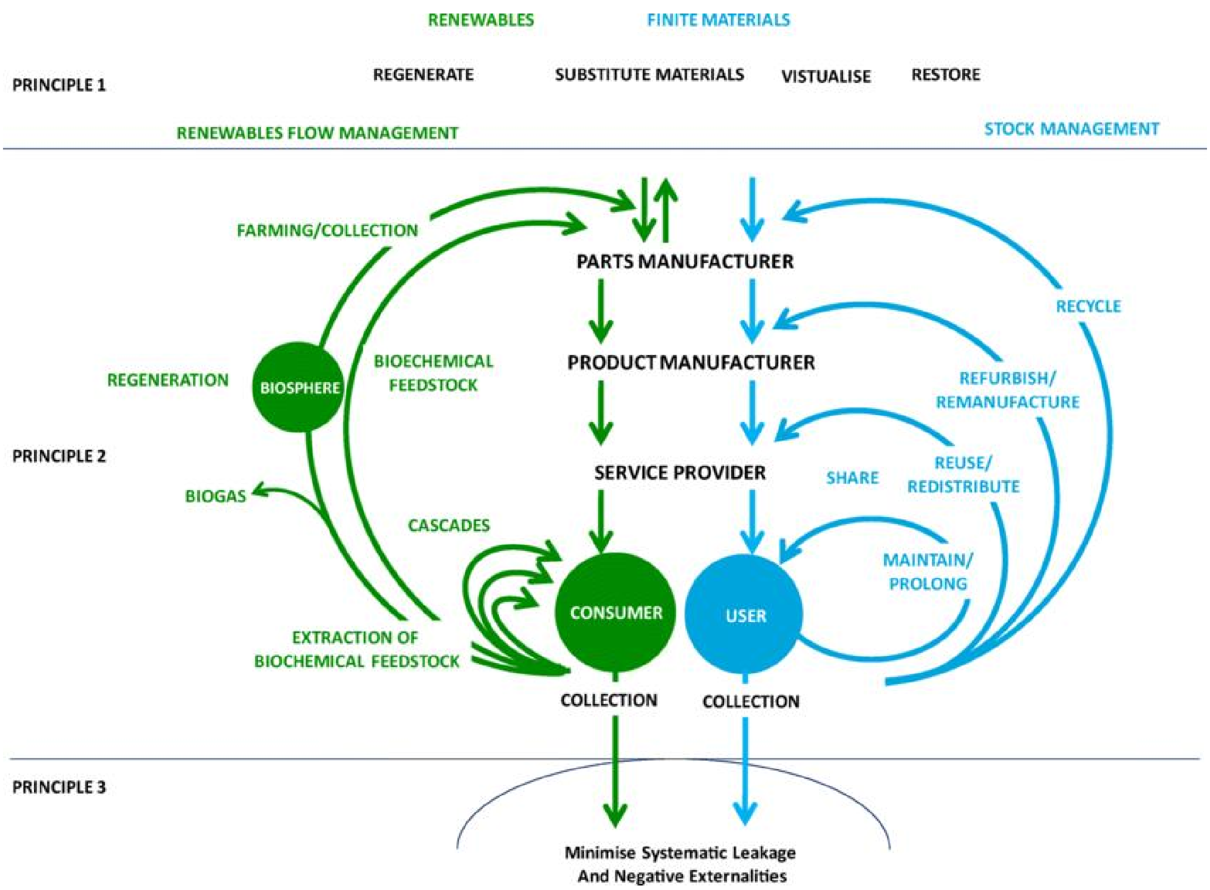
This combination of sources allows for triangulation of findings, ensuring that both global best practices and local realities are integrated into the assessment.

3.3 Conceptual framework adopted

The research applies the circular economy model as a conceptual framework, focusing on three fundamental principles:

1. **Designing out waste and pollution** – by promoting eco-design, industrial symbiosis, and recycling initiatives;
2. **Keeping products and materials in use** – through reuse, repair, refurbishment, and remanufacturing within industrial systems;
3. **Regenerating natural systems** – by aligning industrial activity with environmental restoration, renewable energy use, and sustainable resource flows.

To visualize these principles, the study refers to the Butterfly Diagram of the Circular Economy, developed by the Ellen MacArthur Foundation and widely adopted in circular economy research (Figure 1).



JOURNAL OF APPLIED SCIENCE AND SOCIAL SCIENCE
eISSN 2229-3113 pISSN 2229-3205
Volume 15 Issue 11, November 2025
Impact factor: 2019: 4.679 2020: 5.015 2021: 5.436, 2022: 5.242, 2023: 6.995, 2024 7.75

Figure 1. *Butterfly model of the circular economy (adapted from Ellen MacArthur Foundation, 2017, via ResearchGate)*[2]

The diagram distinguishes between the **biological cycle** (green loop), which emphasizes regeneration of ecosystems through processes such as composting, bioenergy, and biochemical feedstock recovery, and the **technical cycle** (blue loop), which highlights strategies such as reuse, repair, refurbishment, remanufacturing, and recycling. By adopting this model, the study provides a framework to analyze how industrial enterprises in Tashkent—particularly in textiles, construction, and food processing—can reduce linear waste flows and incorporate circular strategies.

The Butterfly Diagram thus serves as both a conceptual foundation and a diagnostic tool for evaluating how Tashkent's industrial systems may transition toward circular practices, aligning resource efficiency with environmental and economic sustainability.

Results

4.1. Current industrial resource use in Tashkent

Tashkent remains the largest industrial hub of Uzbekistan, with major sectors including textiles, food processing, construction materials, and chemicals. Industrial activity is resource-intensive, relying heavily on natural gas for energy and virgin raw materials for manufacturing. National data show that Uzbekistan's resource productivity is significantly lower than the EU average, reflecting high energy intensity and inefficient industrial practices (World Bank, 2024). This underscores the persistence of linear resource flows in Tashkent's industries and the limited penetration of circular economy (CE) practices.

4.2. Waste generation and management practices

Waste generation in Tashkent mirrors the scale of its urban and industrial activity. Although precise city-level data remain limited, national statistics indicate that Uzbekistan generates around 7 million tonnes of solid household waste annually, of which only about 1.8 million tonnes (≈ 26%) is recycled (E-Waste Monitor, 2024). According to World Bank assessments, the recycling rate for municipal solid waste remains below 10% nationally, compared to approximately 50% in the European Union (World Bank, 2024). The majority of waste is still disposed of in open landfills, with limited segregation or recovery systems. Construction and demolition waste is particularly problematic, given Tashkent's rapid urban expansion. While several waste sorting facilities have been introduced under the Tashkent Solid Waste

[2] Source: https://www.researchgate.net/figure/Butterfly-model-of-circular-economy-adapted-from-Ellen-Macarthur-Foundation-2017_fig6_344261566

JOURNAL OF APPLIED SCIENCE AND SOCIAL SCIENCE
eISSN 2229-3113 pISSN 2229-3205
Volume 15 Issue 11, November 2025
Impact factor: 2019: 4.679 2020: 5.015 2021: 5.436, 2022: 5.242, 2023: 6.995, 2024 7.75

Management Project, their capacity remains insufficient to handle the total waste produced (World Bank, 2013).

Figure 2 illustrates the comparative recycling rates of municipal solid waste across selected countries, highlighting significant disparities between developed and developing economies. The European Union leads with nearly 48% of municipal waste recycled, while the United States and Canada report moderate diversion rates of around 32% and 27%, respectively. Japan and Kazakhstan fall in the middle range, with approximately 20–24% recycling performance. In contrast, Uzbekistan and Brazil show very low recycling rates, under 10% and 5% respectively, reflecting limited infrastructure, investment, and policy enforcement. The figure underscores the gap between Central Asian and Latin American contexts compared to OECD benchmarks, reinforcing the need for targeted interventions in cities such as Tashkent.

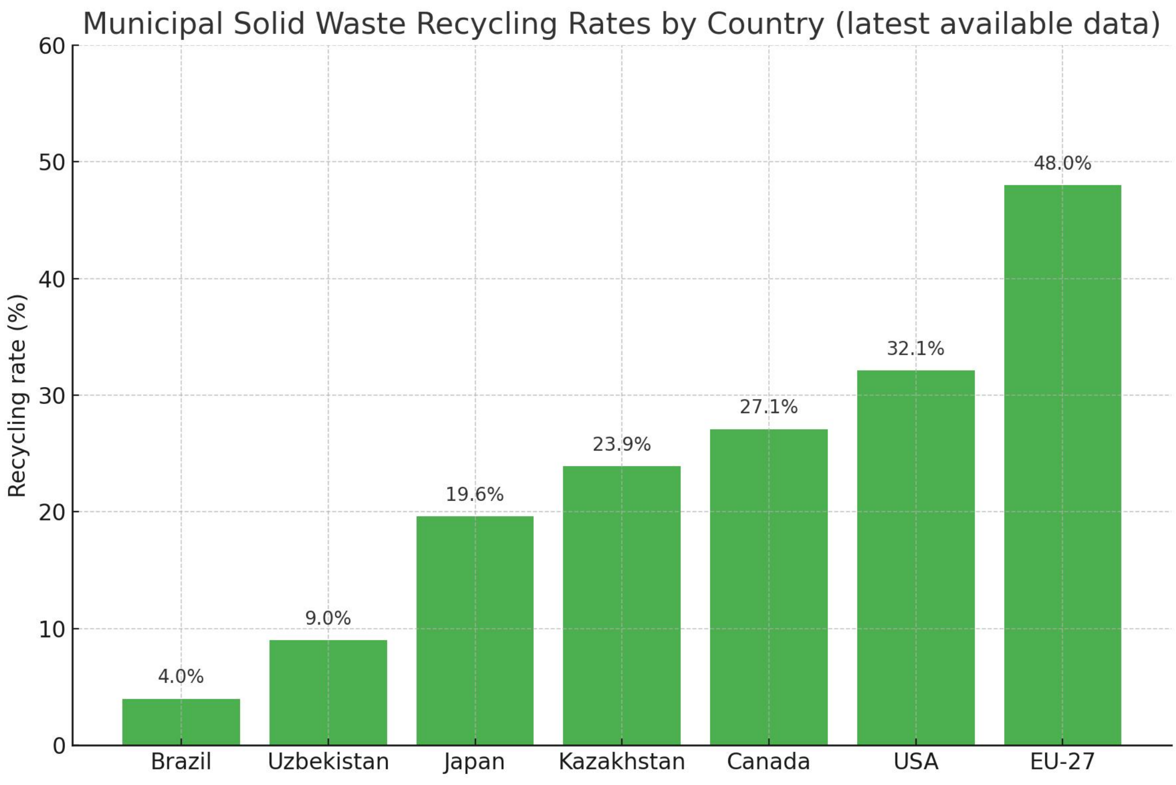


Figure 2. Municipal solid waste recycling rates by country[3]

Figure 3, in turn, illustrates that while waste generation in Tashkent has steadily increased since 2010, treatment capacity has remained very limited, covering less than 10 percent of total waste until 2024. A sharp rise in capacity is projected after 2027 with the commissioning of the waste-

[3] Compiled by the author based on *World Bank 2024; E-Waste Monitor 2024; U.S. EPA 2018; Environment Canada 2022; Eurostat 2022; Japan MOE 2022; Kazakhstan national statistics 2023; Brazil sectoral reports 2022*

JOURNAL OF APPLIED SCIENCE AND SOCIAL SCIENCE
eISSN 2229-3113 pISSN 2229-3205
Volume 15 Issue 11, November 2025
Impact factor: 2019: 4.679 2020: 5.015 2021: 5.436, 2022: 5.242, 2023: 6.995, 2024 7.75

to-energy plant, yet even with this addition, overall treatment will not fully match the city's growing waste output. This gap underscores the urgency of scaling up recycling infrastructure and policy measures to complement energy recovery initiatives.

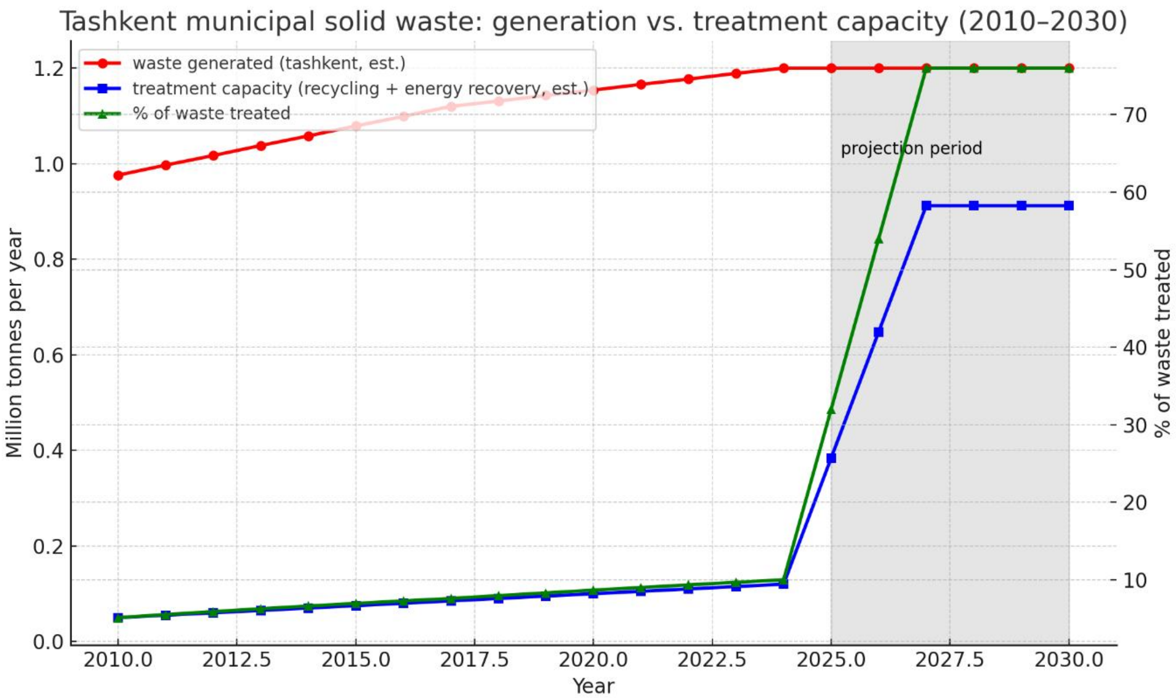


Figure 3. *Tashkent municipal solid waste: generation vs. treatment capacity and percentage treated (2010–2030)*[4]

4.3. Barriers to circular economy adoption

Three categories of barriers limit CE adoption in Tashkent's industrial systems:

- **Technological barriers**: enterprises often use outdated machinery, with limited access to recycling technologies or industrial symbiosis networks.
- **Financial barriers**: green financing instruments are underdeveloped, and many firms—particularly SMEs—struggle to mobilize investment for eco-innovation (World Bank, 2024).
- **Regulatory and institutional barriers**: although the *Strategy for the Transition to a Green Economy (2019–2030)* establishes ambitious national targets, enforcement at the city level

[4] The graph was sketched by the author using data from *UNDP (2024), ITU (2022), E-Waste Monitor (2024), World Bank (2024), and official announcements on waste-to-energy capacity (2024)*

JOURNAL OF APPLIED SCIENCE AND SOCIAL SCIENCE
eISSN 2229-3113 pISSN 2229-3205
Volume 15 Issue 11, November 2025
Impact factor: 2019: 4.679 2020: 5.015 2021: 5.436, 2022: 5.242, 2023: 6.995, 2024 7.75

remains weak. The absence of extended producer responsibility (EPR) schemes and fragmented waste management regulations further slow adoption (Republic of Uzbekistan, 2019).

4.4. Opportunities and potential strategies

Despite these constraints, several opportunities exist for embedding CE principles into Tashkent's industrial systems:

- **Innovation and technology transfer**: upgrading to energy-efficient technologies and adopting modern recycling infrastructure could reduce resource intensity and waste.
- **Public–private partnerships (PPPs)**: collaborative efforts between municipalities, enterprises, and international organizations can drive investment in recycling facilities, renewable energy, and eco-industrial parks (World Bank, 2013).
- **Green investment mechanisms**: expanding the use of green bonds, concessional loans, and investment incentives would help mobilize financial resources for circular projects.
- **Policy enhancement**: strengthening local enforcement, introducing eco-design standards, and implementing extended producer responsibility schemes could create a regulatory framework supportive of CE adoption.

Tashkent has significant potential to transition from a linear to a circular industrial model. By leveraging technological innovation, policy reforms, and financing mechanisms, the city can reduce its dependence on resource-intensive production while contributing to Uzbekistan's national green economy agenda.

Discussion

The results demonstrate that Tashkent's industrial and municipal systems continue to operate largely on a linear model, with waste generation outpacing treatment capacity. As shown in Figure 2, Uzbekistan's recycling rate remains below 10 percent, placing it at the bottom alongside Brazil, while OECD economies such as the European Union, the United States, and Japan achieve significantly higher levels of recycling performance. Table 1 further illustrates how global and regional research has examined circular economy adoption, while localized studies in Central Asia remain scarce. Figure 3 adds to this evidence by showing the persistent gap between rising waste generation and limited treatment capacity in Tashkent, with only a projected improvement after 2027 when the waste-to-energy plant is expected to become operational. This highlights the urgent need for comprehensive circular strategies to complement infrastructure investments.

The comparative evidence suggests that technological modernization alone cannot address Tashkent's challenges. While recycling plants and energy recovery facilities are important, barriers identified in this study—technological gaps, weak regulatory enforcement, and insufficient financial incentives—limit the scalability of circular practices. The experience of Kazakhstan, where recycling reached nearly 24 percent in 2023, demonstrates that regulatory

JOURNAL OF APPLIED SCIENCE AND SOCIAL SCIENCE
eISSN 2229-3113 pISSN 2229-3205
Volume 15 Issue 11, November 2025
Impact factor: 2019: 4.679 2020: 5.015 2021: 5.436, 2022: 5.242, 2023: 6.995, 2024 7.75

reforms and investment frameworks can accelerate progress (Times of Central Asia, 2023). Similarly, Canada's diversion policies and Japan's eco-design standards provide models for integrating households, industries, and municipalities into broader circular systems (Environment and Climate Change Canada, 2024; Ministry of the Environment Japan, 2023). These comparisons underline that Tashkent requires not only infrastructure but also institutional reforms such as extended producer responsibility (SWITCH-Asia, 2022) and incentives for eco-innovation.

At the same time, the findings point to significant opportunities for Tashkent to become a national leader in circular economy adoption. The results on waste composition and trends show that construction and demolition waste represent a major challenge, but also a strategic entry point for recycling secondary raw materials and developing industrial symbiosis with manufacturing and energy sectors. Integrating biological cycles such as composting with technical cycles of repair, reuse, and remanufacturing, as presented in the butterfly model (Figure 1), offers a pathway for balanced resource management. By combining international best practices, targeted local reforms, and investment in both recycling and energy recovery, Tashkent can position itself as a model city for circular economy transitions in Uzbekistan and potentially across Central Asia.

Conclusion

This study showed that Tashkent faces growing pressure from rising waste generation while recycling and treatment capacity remain limited, covering less than 10 percent of total municipal solid waste. Comparative evidence (Table 1, Figure 2) confirmed that Uzbekistan lags far behind OECD countries, and trend analysis (Figure 3) highlighted a widening gap between generation and treatment capacity until the planned waste-to-energy facility comes online in 2027. These findings underline the structural barriers of outdated technology, weak regulation, and limited financing that continue to slow the adoption of circular economy practices.

At the same time, the results point to clear opportunities. Expanding recycling infrastructure, strengthening regulatory frameworks such as extended producer responsibility, and promoting public–private partnerships could significantly accelerate progress. By integrating technical cycles of reuse and recycling with biological cycles such as composting, Tashkent has the potential to serve as a model for circular economy transition in Uzbekistan and the wider Central Asian region.

References :

1. Brazilian Institute of Geography and Statistics (IBGE). (2022). *Selective waste collection survey 2022*. Rio de Janeiro: IBGE. Retrieved from https://www.ibge.gov.br
2. Circle Economy. (2024). *Circularity Gap Report 2024*. Amsterdam: Circle Economy Foundation. https://www.circularity-gap.world/2024

3. Dennison, J., Milios, L., & Johansson, N. (2024). Manufacturing and the circular economy: Opportunities and systemic challenges. *Sustainable Production and Consumption, 41,* 222–234. https://doi.org/10.1016/j.spc.2024.02.009
4. Despeisse, M., Baumers, M., Brown, P., & Charnley, F. (2022). Unlocking eco-efficiency through circular economy practices in industrial systems. *Journal of Industrial Ecology, 26*(5), 1378–1392. https://doi.org/10.1111/jiec.13215
5. Ellen MacArthur Foundation. (2023). *What is a circular economy?* Ellen MacArthur Foundation. https://ellenmacarthurfoundation.org/topics/circular-economy-introduction/overview
6. Environment and Climate Change Canada. (2024). *Municipal solid waste diversion indicator*. Ottawa: Government of Canada. Retrieved from https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/municipal-solid-waste-diversion.html
7. Eurostat. (2023). *Recycling rate of municipal waste (tsdpc240)*. Luxembourg: European Commission. Retrieved from https://ec.europa.eu/eurostat/databrowser/view/tsdpc240
8. European Commission. (2020). *A new Circular Economy Action Plan: For a cleaner and more competitive Europe*. Brussels: European Union. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0098
9. E-Waste Monitor. (2024). *National E-waste Monitor: Uzbekistan*. Bonn: UNU/UNITAR. Retrieved from https://ewastemonitor.info/wp-content/uploads/2024/10/National_E-waste_Monitor_Uzbekistan_EN_WEB.pdf
10. Georgescu, M., Mazzanti, M., & Nicolli, F. (2025). Drivers of recycling and resource efficiency: Evidence from European circular economy practices. *Environmental Sciences Europe, 37,* 56. https://doi.org/10.1186/s12302-025-01119-4
11. Karimov, B. (2023). The barriers of adopting circular business practices in rural SMEs: Evidence from Uzbekistan. *Open Journal of Business and Management, 11*(7), 3514–3528. https://doi.org/10.4236/ojbm.2023.117197
12. Ministry of the Environment, Japan (MOE). (2023). *FY2022 Annual report on the state of the environment in Japan*. Tokyo: Government of Japan. Retrieved from https://www.env.go.jp
13. Nikolakis, W., Brown, H., & Cohen, R. (2024). Quantitative frameworks for assessing circular economy strategies in manufacturing. *Journal of Cleaner Production, 412,* 137845. https://doi.org/10.1016/j.jclepro.2023.137845
14. OECD. (2020). *The circular economy in cities and regions*. Paris: OECD Publishing. https://doi.org/10.1787/10ac6ae4-en
15. Republic of Uzbekistan. (2019). *On the approval of the Strategy for Transition of the Republic of Uzbekistan to a Green Economy for 2019–2030 (Resolution No. PP-4477).* National Database of Legislation (LEX.UZ). https://lex.uz/en/docs/7582760
16. SWITCH-Asia. (2022). *Extended producer responsibility in Kazakhstan: Policy brief.* Brussels: SWITCH-Asia Policy Support Component. Retrieved from https://www.switch-asia.eu
17. SWITCH-Asia. (2022). *Promotion of the Green Economy Strategy in Uzbekistan: The textile and garment sector.* SWITCH-Asia Programme. https://www.switch-asia.eu/resource/promotion-of-the-green-economy-strategy-in-uzbekistan-the-textile-and-garment-sector
18. Times of Central Asia. (2023). *Kazakhstan's municipal waste recycling rate drops to*

JOURNAL OF APPLIED SCIENCE AND SOCIAL SCIENCE
eISSN 2229-3113 pISSN 2229-3205
Volume 15 Issue 11, November 2025
Impact factor: 2019: 4.679 2020: 5.015 2021: 5.436, 2022: 5.242, 2023: 6.995, 2024 7.75

23.9% in 2023. Bishkek: Times of Central Asia. Retrieved from https://timesca.com
19. UN-Habitat. (2020). *World Cities Report 2020: The value of sustainable urbanization.* Nairobi: United Nations Human Settlements Programme. https://unhabitat.org/World-Cities-Report-2020
20. World Bank. (2013). *Tashkent Solid Waste Management Project (Project Appraisal Document, Report No. 74403-UZ).* Washington, DC: The World Bank. https://documents.worldbank.org/en/publication/documents-reports/documentdetail/430041468131973481/
21. World Bank. (2024). *Circular economy opportunities in Central Asia: Policy note.* Washington, DC: The World Bank. https://documents1.worldbank.org/curated/en/099052024074569900/pdf/P1708701a3dabb0e11b7b11feb6167f2ecb.pdf