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Assessing the Readiness of Windhoek for Circular Economy Implementation: Recycling Infrastructure and Public Awareness

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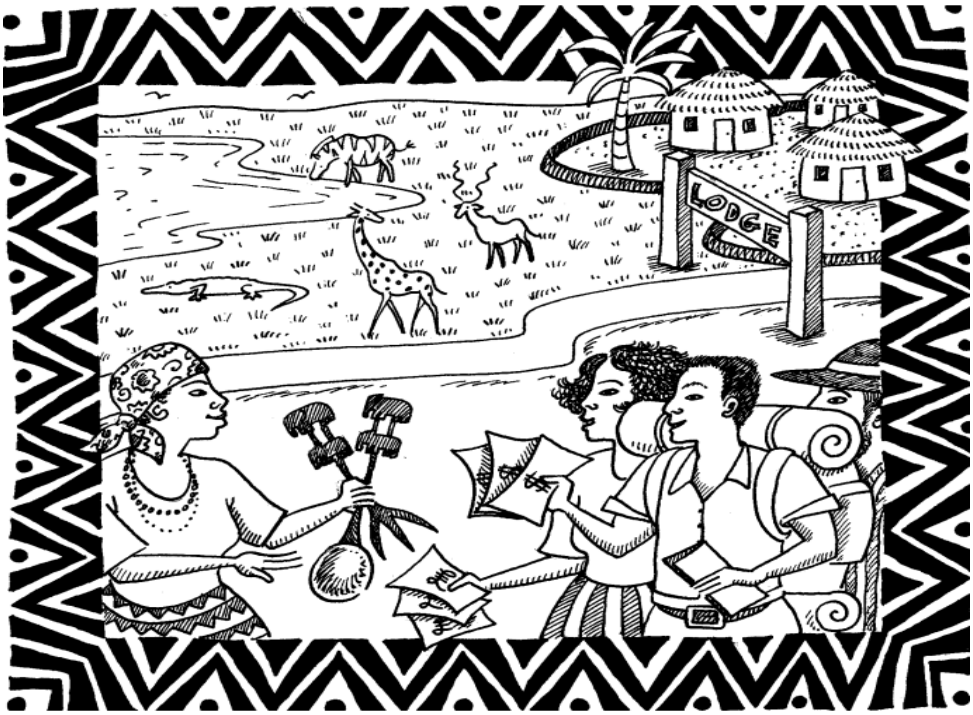

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Abstract

The global transition from linear "take–make–dispose" economic models to circular economy (CE) is increasingly recognized as essential for sustainable urban development. In Africa, where urbanization is accelerating, cities face mounting waste management challenges but also opportunities to embed CE principles. Namibia's capital, Windhoek, offers a pioneering case through initiatives such as the EU-funded Waste Buy-Back Centre (WBBC) and its Integrated Waste Management Plan (IWMP, 2022–2027). This paper evaluates Windhoek's readiness for CE implementation by examining four levers: technological infrastructure, governance frameworks, economic models, and social participation. Drawing on municipal reports, project documentation, and secondary literature, the study finds that Windhoek has made notable progress through recycling infrastructure and public engagement, yet significant challenges remain in scaling access, digitalizing systems, and institutionalizing CE in governance and industry. A comparative discussion with modern CE leaders such as the European Union, Japan, and South Korea highlights structural gaps and offers pathways for Namibia's alignment. Recommendations include expanding WBBCs across the city, incentivizing private-sector innovation, embedding CE into urban planning, and strengthening citizen awareness. Windhoek's progress contributes to global debates on CE readiness while aligning with SDGs 3, 8, 12, and 13.

Keywords: Circular Economy (CE); Urban Sustainability; Waste Management; Windhoek; Namibia; Recycling Infrastructure; Governance Frameworks; Economic Models; Social Participation; Waste Buy-Back Centre (WBBC); Integrated Waste Management Plan (IWMP); Policy Alignment; Sustainable Development Goals (SDGs).

List of Abbreviations

Abbreviation	Meaning
CE	Circular Economy
EMA	Environmental Management Act
EPR	Extended Producer Responsibility
EU	European Union
GIS	Geographic Information System
ICT	Information and Communication Technology
IoT	Internet of Things
ISWM	Integrated Sustainable Waste Management
IWMP	Integrated Waste Management Plan
MEFT	Ministry of Environment, Forestry and Tourism
MET	Ministry of Environment and Tourism
MFA	Material Flow Analysis
MLP	Multi-Level Perspective
NDP5	Fifth National Development Plan
NDP6	Sixth National Development Plan
NPC	National Planning Commission
PPP	Public-Private Partnership
SDG	Sustainable Development Goal
WBBC	Waste Buy-Back Centre
UNDP	United Nations Development Programme

1. Introduction

The traditional linear economy, characterized by extraction, production, consumption, and disposal, has reached its environmental, economic, and social limits. This model has proven unsustainable in the face of rising global population, rapid urbanization, and escalating resource depletion. Consequently, the circular economy (CE) has emerged as a transformative framework that redefines growth by decoupling economic activity from the consumption of finite resources. CE frameworks emphasize waste prevention, resource efficiency, reuse, recycling, and recovery, providing a pathway toward sustainable growth, particularly in urban contexts where waste management pressures are most acute (Ghisellini et al., 2016).

Globally, CE is closely linked with the rise of "smart cities," which integrate technology, governance, and innovation to enhance efficiency, sustainability, and quality of life (Esmaeilian et al., 2018). Smart city initiatives worldwide demonstrate how circular strategies, such as digital tracking of waste flows, sensor-based recycling bins, and green public procurement, can foster cleaner, more resilient urban systems. Cities like Amsterdam, Copenhagen, and Singapore have positioned circularity at the heart of their sustainability agendas, setting benchmarks that developing cities like Windhoek can learn from and adapt within local contexts.

Windhoek, Namibia's capital, presents a unique and pioneering African case for assessing CE readiness. The city faces acute waste management challenges resulting from rapid population growth, increased urban migration, limited landfill capacity, and persistent socio-economic inequalities. These challenges are compounded by the city's semi-arid geography, which restricts natural resource regeneration and amplifies the need for efficient waste and water reuse systems. Despite these constraints, Windhoek has taken deliberate and promising steps toward circularity. The establishment of the Waste Buy-Back Centre (WBBC) in Katutura in 2024, supported by €2.2 million in EU–Bremen funding, represents a landmark intervention in incentivized recycling and community participation(Nambadja, 2025). Complementing this initiative, the Integrated Waste Management Plan (IWMP 2022–2027) outlines strategic policy directions to embed CE

principles within municipal planning, emphasizing stakeholder collaboration, public education, and sustainable waste reduction (City of Windhoek, 2022).

Namibia's broader legislative and institutional framework also plays a critical role in shaping the country's circular economy transition. The Environmental Management Act (EMA) No. 7 of 2007, administered by the Ministry of Environment, Forestry and Tourism (MEFT), provides the overarching legal framework for environmental protection and sustainable resource use (Republic of Namibia, 2007). However, as the EMA is currently under review for amendment, several provisions still lack explicit reference to circular economy principles such as extended producer responsibility (EPR), eco-design, and waste valorization. Similarly, the Solid Waste Management Regulations and the National Solid Waste Management Strategy (2018–2023) establish foundational guidelines for waste minimization but face challenges in enforcement, funding, and inter-agency coordination (Ministry of Environment and Tourism [MET], 2018). These legislative limitations may constrain private sector participation and innovation in CE-driven industries, particularly in the recycling, repair, and renewable energy sectors.

Other relevant policies such as Namibia's sixth National Development Plan (NDP6), Vision 2030, and the forthcoming National Circular Economy Strategy (currently under development by MEFT in collaboration with the EU and UNDP) further demonstrate growing political commitment toward sustainable resource management (National Planning Commission [NPC], 2017; Republic of Namibia, 2004). However, the absence of harmonized implementation mechanisms and measurable CE indicators continues to impede progress. Addressing these policy and institutional gaps is essential if Windhoek is to scale its pilot initiatives into a coherent, city-wide circular economy model.

This study evaluates Windhoek's readiness for CE implementation using a qualitative case study approach. Data were drawn from municipal policy documents, project reports, and secondary academic and media sources. A thematic analysis was conducted using the framework of Aligod and Kaoud (2023), which identifies four levers of CE readiness: technological infrastructure, governance, economic models, and social participation. The central research question guiding this analysis is: To what extent is Windhoek prepared for

circular economy implementation, and what factors enable or constrain its readiness compared to global best practices?

By situating Windhoek's experience within both the national policy context and global CE discourse, the study seeks to uncover practical pathways for advancing Namibia's transition toward a more circular, inclusive, and sustainable urban future.

2. Literature Review

2.1 Overview and Organisation of the Review

This literature review is structured into two major sections. The first section (theoretical literature) synthesises foundational theories and conceptual models that underpin the circular economy (CE), waste hierarchy, smart-city frameworks, and socio-technical transition theories. The second section (empirical literature) surveys applied studies and experiences, globally, regionally (Africa), and locally (Namibia/Windhoek), that demonstrate how these theories are implemented in practice.

To maintain analytical coherence, the review employs the four levers of CE readiness, technological infrastructure, governance, economic models, and social participation, proposed by Aligod and Kaoud (2023). These levers serve as an organising framework linking theoretical constructs with empirical observations and guiding the conceptual model later recommended for Namibia.

2.2 Theoretical Literature

2.2.1 Circular Economy and the Waste Hierarchy

The circular economy (CE) represents a systemic transformation from the linear "take, make, dispose" production model toward one centred on resource regeneration, reuse, and closed-loop value creation (Kirchherr et al., 2017). The waste hierarchy, reduce, reuse, recycle, recover, and disposal as a last resort, forms the operational backbone of CE implementation (Ghisellini et al., 2016).

This hierarchy prioritises upstream interventions such as waste prevention, eco-design, and product reuse, which generate greater environmental and social benefits than downstream solutions like landfilling or incineration. Theoretically, it aligns with systems thinking, where cities are understood as interconnected networks of material and energy flows. For municipalities such as Windhoek, this framework offers an actionable guide to shift from landfill dependency toward prevention, reuse, and resource recovery (City of Windhoek, 2022).

2.2.2 Smart Cities, Digitalisation, and Socio-Technical Transitions

Smart city literature positions digital technologies, including the Internet of Things (IoT), sensors, and data analytics, as tools to optimise waste collection, enhance recycling efficiency, and inform evidence-based decision-making (Esmaeilian et al., 2018). In this paradigm, data-driven management enables municipalities to track waste flows, improve collection routes, and support citizen participation through digital feedback systems.

However, as Geels (2002, 2011) explains through the Multi-Level Perspective (MLP) of socio-technical transitions, technological innovation alone does not achieve sustainability. Systemic transformation requires co-evolution among technology, governance, user practices, and institutional structures. Within this framework:

- **Niches** represent innovative experiments or pilots (e.g., Windhoek's Waste Buy-Back Centre).
- **Regimes** comprise dominant institutional and infrastructural systems (e.g., municipal waste management).
- **Landscapes** denote broader socio-economic pressures (e.g., policy reforms or international funding trends).

In Namibia's context, this perspective clarifies how local CE initiatives, like the Waste Buy-Back Centre (WBBC), can scale only when integrated with national policy frameworks and municipal institutional reforms, including amendments to the Environmental Management Act (Republic of Namibia, forthcoming).

2.2.3 Urban Metabolism and Resource Flow Models

Urban metabolism conceptualises cities as living systems that consume resources and generate waste (Kennedy, Cuddihy, & Engel-Yan, 2007). This model quantifies material and energy flows, allowing policymakers to identify points where substitution, recycling, or reduction can yield the highest impact.

For Windhoek, the urban metabolism approach can support the development of material flow analyses (MFA) to determine per-capita waste generation, recycling rates, and landfill diversion. These data form the evidence base for prioritising interventions such as organic waste composting, construction material reuse, and water recycling, particularly vital in Namibia's semi-arid environment.

2.2.4 Integrated Sustainable Waste Management (ISWM) and Governance Theory

The Integrated Sustainable Waste Management (ISWM) model (Van de Klundert & Anschütz, 2001) provides a multidimensional framework combining technical, environmental, financial, and social dimensions of waste management. It emphasises stakeholder engagement, decentralisation, and the integration of the informal sector, recognising waste pickers and small enterprises as vital actors in resource recovery (Wilson, Velis, & Cheeseman, 2006).

From a governance perspective, CE transitions often face institutional fragmentation, unclear mandates, and financing gaps. Effective implementation depends on institutional coherence, enforcement capacity, and sustainable revenue models such as Extended Producer Responsibility (EPR) and "pay-as-you-throw" systems (Preston, 2012). Namibia's IWMP (City of Windhoek, 2022) and national reforms under the Environmental Management Act (Republic of Namibia, 2007) illustrate a shift toward such coordinated and inclusive governance.

2.2.5 The Four Levers of Circular Economy Readiness

Aligod and Kaoud (2023) identify four interrelated levers, technological infrastructure, governance, economic models, and social participation, as determinants of a city's readiness for circular economy transition.

- *Technological infrastructure* relates to waste collection systems, digital monitoring, and processing facilities.
- *Governance* encompasses institutional mandates, coordination mechanisms, and policy enforcement.
- *Economic models* include financial incentives, business innovation, and market instruments.
- *Social participation* covers awareness, behavioural change, and stakeholder inclusion.

Together, these levers integrate the theories discussed above, offering a practical framework for diagnosing Windhoek's readiness and guiding future interventions.

2.3 Empirical Literature

2.3.1 Global Evidence on Urban Circular Economy Transitions

Empirical studies from cities such as Amsterdam, Copenhagen, Seoul, and Tokyo demonstrate that CE transitions succeed where governments combine regulation, incentives, and participatory governance (Prendeville, Cherim, & Bocken, 2018). Successful cases typically feature:

- **Economic Incentives:** "Pay-as-you-throw" systems implemented in cities like Seoul and Copenhagen incentivize waste reduction by linking disposal costs to

waste volume. Such models encourage households and businesses to separate recyclables and minimize residual waste.

- **Integration of Informal and Local Actors:** In Tokyo and parts of Latin America, informal waste collectors and small enterprises are formally recognized and integrated into municipal recycling systems. This approach enhances social inclusion, improves recycling rates, and supports green job creation.
- **Digitalization and Smart Infrastructure:** Cities such as Amsterdam and Singapore leverage digital tools—IoT-enabled bins, RFID tracking, and GIS-based waste mapping—to optimize collection routes, monitor recycling performance, and engage citizens through feedback platforms.
- **Long-Term Political Commitment and Citizen Engagement:** Sustained CE implementation requires consistent policy support, cross-sectoral coordination, and public education. In Seoul, for example, food waste recycling rates exceed 95% due to mandatory separation, smart-card payment systems, and widespread community participation.

Digitalisation and public procurement have also been pivotal in aligning CE with urban sustainability agendas (European Commission, 2020; Park & Park, 2020; Tan, 2022; Yoshida, 2021). These cities have institutionalized CE principles through national legislation, municipal planning, and public-private partnerships, offering valuable lessons for Windhoek's evolving CE landscape.

2.3.2 Circular Economy Implementation in Developing Country Contexts

In lower- and middle-income countries, CE implementation faces structural challenges such as weak infrastructure, limited budgets, and fragmented institutions (Olawumi & Chan, 2018). Yet, innovative community-driven solutions and hybrid financing models have emerged as context-appropriate strategies.

Key insights include:

- Integration of the Informal Sector: Studies from South Africa, India, and Brazil highlight the critical role of informal waste pickers and micro-enterprises in resource recovery. When formally recognised and supported through cooperatives, training, and access to markets, these actors significantly improve recycling rates and contribute to inclusive economic development (Godfrey, Strydom, & Phukubye, 2019; Wilson, Velis, & Cheeseman, 2006).
- Decentralised and Low-Cost Solutions: Rather than relying on capital-intensive infrastructure, many cities have adopted decentralised models such as community composting, small-scale materials recovery facilities (MRFs), and mobile collection units. These approaches are more adaptable to informal settlements and peri-urban areas, where service delivery is often limited (Van de Klundert & Anschütz, 2001).
- Hybrid Financing Models: Blended finance mechanisms—combining donor support, microfinance, and public-private partnerships—have proven effective in scaling CE initiatives. For example, waste cooperatives in Kenya and Ghana have leveraged microloans to expand operations, while donor-funded pilots in Rwanda have catalysed national policy reforms (Olawumi & Chan, 2018).
- Appropriate Technology and Local Innovation: CE success in developing countries often hinges on the use of affordable, locally adapted technologies. Examples include manual balers, low-energy shredders, and mobile apps for waste collection coordination. These tools enhance efficiency without requiring high capital investment or advanced technical skills (Van de Klundert & Anschütz, 2001).
- Policy Alignment and Capacity Building: Countries such as Colombia and Indonesia have made progress by embedding CE principles into national development plans and environmental legislation. However, implementation success depends on building institutional capacity at the municipal level, including training, monitoring systems, and inter-agency coordination (Olawumi & Chan, 2018).

For Namibia, these lessons underscore the importance of leveraging local strengths such as a vibrant informal recycling sector and strong community networks while addressing

institutional gaps through targeted policy reform and capacity development. Windhoek's Waste Buy-Back Centre (WBBC) already reflects several of these principles, but broader replication will require decentralized infrastructure, inclusive governance, and innovative financing mechanisms tailored to Namibia's socio-economic landscape.

2.3.3 Namibia and Windhoek-Specific Empirical Insights

Empirical evidence from Windhoek highlights both progress and gaps. The Integrated Waste Management Plan (IWMP) 2022–2027 provides a policy foundation for CE initiatives, while pilot projects such as the Waste Buy-Back Centre (WBBC) showcase practical innovation. However, challenges persist,namely, limited landfill diversion rates, absence of formal EPR systems, data deficiencies, and insufficient integration of informal recyclers and low recovery rate of recyclables from landfills creating legacy waste (City of Windhoek, 2022; Ndebele, 2024).

At the national level, the forthcoming Draft National Circular Economy Strategy and the Sixth National Development Plan (NDP6) (National Planning Commission, 2025) reflect growing policy commitment to CE principles. Yet, effective implementation will depend on stronger coordination between municipal and national frameworks, as well as clear monitoring indicators.

2.4 Recommended Conceptual Model for Namibia: A Hybrid Framework

2.4.1 Rationale

Given Namibia's development context—characterised by limited fiscal resources, a vibrant informal recycling sector, and evolving regulatory frameworks, a hybrid model that integrates ISWM, Urban Metabolism, and MLP provides the most contextually appropriate analytical and operational framework. This model links theory to practice, balancing system-wide transformation with local feasibility.

2.4.2 Model Components and Application to Windhoek

Model Component	Purpose	Application in Windhoek	Key Municipal Actions	Suggested Indicators
Integrated Sustainable Waste Management (ISWM)	Strengthen technical, social, and institutional waste systems through inclusive participation	Integrate WBBC with informal recyclers; establish micro-recycling hubs	Form waste-picker cooperatives; incentivize local recycling enterprises	% of waste formally recycled; number of cooperatives formed; municipal waste budget share
Urban Metabolism	Quantify and optimize material and energy flows	Conduct city-wide material flow analysis (MFA)	Identify priority waste streams (organic, plastic, construction)	Per-capita waste generation (kg/day); recycling and diversion rates (%)
Multi-Level Perspective (MLP)	Guide systemic transition and policy alignment	Scale CE pilots (e.g., WBBC) through by-law and EMA reform	Institutionalize CE principles in IWMP updates; strengthen coordination with MEFT	Number of CE-aligned policies; CE funding allocations
Four Levers Framework	Evaluate readiness across key domains	Diagnose strengths and weaknesses in CE transition	Apply framework to all planning and monitoring exercises	CE readiness index; stakeholder participation rate; ICT-enabled waste operations coverage

2.5 Gaps in the Literature and Implications for the Study

Despite growing research on circular economy practices, several gaps persist:

- **Measurement gaps**: Limited baseline data on material flows hinder rigorous CE monitoring and cross-city comparisons.
- **Contextual evidence**: Few long-term studies examine scaling of informal-sector integration and community recycling models in southern Africa.
- **Policy integration**: Disconnects remain between national aspirations (e.g., Vision 2030, NDP6) and municipal-level implementation tools.

These gaps justify the present study's focus on assessing Windhoek's readiness for CE implementation. By integrating the four-lever framework and the hybrid model, the study seeks to evaluate current preparedness, identify institutional and infrastructural gaps, and propose practical, evidence-based pathways to scale CE within Windhoek's unique urban context.

3. Findings and Discussion

3.1 Technological Infrastructure

Windhoek's Waste Buy-Back Centre (WBBC) in Katutura represents the city's most significant innovation in advancing circular economy (CE) principles. The center incentivizes residents to exchange recyclable materials, such as plastics, glass, paper, and aluminum cans, for cash or shopping vouchers, thereby integrating social and environmental benefits. Since its launch, the WBBC has reportedly paid out over N$164,000 and diverted thousands of tonnes of recyclables from landfill sites (Ndebele, 2024; *Windhoek Express*, 2024). This facility not only improves material recovery but also fosters inclusion of the informal waste sector, creating green jobs and encouraging waste segregation at source.

In addition, the ongoing pre-feasibility study for a waste-to-energy plant at the Kupferberg Landfill demonstrates Windhoek's recognition of energy recovery as a frontier of CE implementation. This aligns with the forthcoming NDP6 (2025–2030) theme of "Building a Circular and Climate-Resilient Economy," which calls for innovation in renewable energy and sustainable urban systems. However, compared to global CE leaders, Windhoek still lacks digitalized waste tracking systems, such as IoT-enabled smart bins, Geographic Information System (GIS) monitoring, and RFID-based collection logistics. These technologies enhance data transparency, optimize collection routes, and reduce costs—areas in which Namibia could make gradual progress through public-private partnerships (PPPs) and donor-supported pilots over the next five years.

3.2 Governance

Governance remains the backbone of CE readiness. Windhoek's Integrated Waste Management Plan (IWMP 2022–2027) embeds CE principles within local waste policies, emphasizing waste minimization, segregation, recycling, and public education. The city's partnership with Bremen, Germany, demonstrates how international cooperation can strengthen municipal capacity through technology transfer and training.

However, several governance limitations constrain progress. First, enforcement capacity is weak due to limited human and financial resources at municipal and inspectorate levels. Second, coordination between departments. including waste management, environmental health, and economic development, remains fragmented. Finally, Namibia still lacks a national CE policy or legislative framework, meaning Windhoek's initiatives rely on localized or donor-funded projects rather than systemic national support.

The ongoing amendment of the Environmental Management Act (EMA) 2007 presents a strategic opportunity to mainstream CE principles such as extended producer responsibility (EPR), eco-design standards, and green procurement. By incorporating these mechanisms, Namibia could institutionalize CE at both national and municipal levels. Furthermore, the Ministry of Environment, Forestry and Tourism (MEFT) could collaborate with the

National Planning Commission to integrate CE indicators into NDP6 implementation frameworks, ensuring that circularity becomes a cross-sectoral planning goal.

3.3 Economic Models

Windhoek's current CE economic model, centered on the WBBC's cash-for-recyclables scheme, demonstrates the potential of incentivized resource recovery. It not only provides direct income to residents but also cultivates a market for secondary materials. The initiative complements the city's growing ecosystem of waste entrepreneurship, where small enterprises collect, sort, and trade recyclables. These micro-level economic activities contribute to poverty reduction and green job creation, both of which are priorities under NDP6's inclusive growth agenda.

Nevertheless, Namibia's CE economy remains nascent and fragmented. The absence of national EPR regulations means that producers and importers are not yet accountable for post-consumer waste. In contrast, global leaders such as the European Union and Japan have adopted EPR to finance recycling systems and reduce waste at source. In Namibia, implementing such frameworks could generate stable revenue streams for municipalities, enabling scaling of CE infrastructure.

To strengthen CE business ecosystems, the government could create green investment incentives, such as tax rebates for recycling industries, low-interest loans for startups under the Development Bank of Namibia, and a national Circular Economy Innovation Fund. These interventions, achievable within five years, would foster public-private collaboration and encourage industrial symbiosis between sectors like construction, agriculture, and energy.

3.4 Social Participation

Social participation forms the social foundation of circularity. Windhoek has undertaken commendable efforts to raise awareness through school outreach programs, community workshops, and social media campaigns led by the WBBC. These efforts have gradually improved public knowledge about recycling and waste separation.

However, participation remains uneven across socio-economic groups. Low-income and informal settlements, which generate large amounts of unmanaged waste, are underrepresented in formal recycling schemes due to distance from collection centers and lack of logistical support. To address this gap, decentralizing WBBCs into suburban clusters, such as Okuryangava, Katutura East, and Otjomuise, would increase accessibility and promote equity in participation.

Namibia's success will depend on inclusive CE engagement, integrating informal waste pickers into formal systems through cooperative models and training. This aligns with the Integrated Sustainable Waste Management (ISWM) principle of social inclusion (van de Klundert & Anschütz, 2001). Additionally, behavioural change campaigns using radio, television, and community influencers can reinforce recycling norms, while school curricula integration of CE topics can ensure long-term cultural shifts.

4. Comparative Insights: Windhoek and Modern CE Leaders

Windhoek's CE progress is regionally significant, but comparison with global CE pioneers highlights both achievements and opportunities for growth.

- **European Union (EU):** The EU's Circular Economy Action Plan (2020) institutionalizes EPR, eco-design, and mandatory recycling targets. Windhoek's project-based approach contrasts with this systemic model, underscoring the need for Namibia to establish national CE governance structures.
- **Japan:** Japan's "Sound Material-Cycle Society" framework integrates CE into national legislation, promoting advanced automation and producer accountability (Yoshida & Yoshida, 2021). Windhoek could adapt these lessons incrementally by prioritizing traceability and waste minimization regulations in manufacturing sectors.
- **South Korea:** Korea's 95% food waste recycling rate demonstrates the effectiveness of mandatory separation, smart-card payment systems, and public

engagement (Park & Park, 2020). Namibia could replicate this through pilot food waste composting programs in schools and markets.

- **Singapore:** The "Zero Waste Masterplan (2019)" combines waste-to-energy plants with strong regulation and public education. Windhoek's pre-feasibility study at Kupferberg aligns with Singapore's model, albeit at an early stage. With strategic investment, Namibia could operationalize such facilities by 2030.

Collectively, these comparisons show that technological innovation, legislative alignment, and public participation are central to CE success. Windhoek's readiness can be enhanced through adaptive learning and gradual localization of best practices.

5. Conclusion and Recommendations

Conclusion

Windhoek stands among Africa's most promising examples of emerging circular economy readiness. The city has demonstrated tangible progress in waste recycling, social inclusion, and strategic policy development. However, readiness remains partial, technology adoption is limited, governance remains donor-dependent, economic models are fragmented, and social engagement uneven.

Compared to CE leaders in Europe and Asia, Windhoek's transition is still in its formative phase. Yet, Namibia's policy momentum under NDP6's circular economy theme presents a historic window for consolidating these gains into a coherent national and municipal framework for circular growth.

Recommendations

To accelerate CE implementation in Windhoek and Namibia at large within the next five years, the following targeted, achievable actions are recommended:

1. **Expand and Decentralize WBBCs:**
   Establish additional buy-back centers across key suburbs and towns, supported by

local cooperatives and mobile collection units to enhance accessibility and participation.

2. **Adopt Smart Waste Technologies:**
   Introduce IoT-enabled bins, digital tracking, and automated sorting systems through pilot projects co-funded by international development partners and local ICT startups.
3. **Strengthen Legislative and Institutional Frameworks:**
   Finalize EMA amendments to incorporate EPR, eco-design, and green procurement provisions. Enact a National Circular Economy Policy aligning with NDP6 and the Green Economy Strategy.
4. **Create Economic Incentives for Circular Innovation:**
   Establish a Circular Economy Innovation Fund and tax incentives for recycling startups, cooperatives, and sustainable manufacturers. Encourage inter-sectoral resource sharing (e.g., construction waste for road material).
5. **Enhance Social Participation and Education:**
   Institutionalize CE education in schools and community programs; formalize informal waste collectors into cooperatives; and implement reward-based schemes to reinforce recycling behavior.
6. **Integrate CE Monitoring into NDP6 Framework:**
   Develop measurable CE indicators such as recycling rate, waste diversion, and circular business adoption, to monitor progress toward national sustainability targets.

By embedding CE principles across technological, institutional, economic, and social systems, Windhoek, and Namibia more broadly, can transition from a linear development pathway toward a regenerative, resource-efficient, and inclusive urban future.

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