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Beyond Linear Economies: Envisioning the Future of Circular Economies in SADC

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African perspectives
Global insights

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Abstract

Departing from the conventional linear economic model, the circular economy emerges as a transformative paradigm with the potential to concurrently address environmental concerns and propel economic development. Its pertinence is accentuated within SADC, where judicious management of abundant minerals and renewable energy resources is imperative. Despite the anticipated economic and environmental dividends, the transition to a circular economy (CE) remains complex. This paper conducts a 'strategic foresight' critical assessment, delving into the future potential of the concept in the region. It discerns emerging possibilities and identifies constraints that impede the seamless integration of CE principles. The core objective is to offer purpose-driven policy and legislative frameworks, cultivating an environment conducive to the growth of nascent CE initiatives while systematically dismantling barriers. The proposed policy recommendations are designed to engage and guide a diverse array of stakeholders. They aim to promote and accelerate the adoption of CE principles and enhance comprehension of regulatory frameworks, incentives and supportive mechanisms crucial for facilitating the transition. Additionally, these recommendations establish a foundational baseline for fostering collaboration, raising awareness and cultivating partnerships essential for promoting collective action. By leveraging these strategic directives, SADC member states can pave the way for purpose-fit and sustainable CEs. The proposed strategies not only guide the practical implementation of these principles but also contribute to the realisation of environmental stewardship and sustainable futures. The research envisions a region at the forefront of CE innovation, embodying a harmonious balance between economic well-being and ecological sustainability.

Introduction: Exploring circular economy possibilities in SADC

In the global pursuit of economic and environmental sustainability, the concept of the circular economy (CE)¹ emerges as a beacon of hope. It represents a departure from linear resource consumption, advocating purposeful design for rejuvenation, reuse and minimised waste. The CE concept holds a dual promise: tackling environmental concerns while driving economic transformation. This transition gains heightened significance in the SADC region, where responsible governance of the abundant mineral and renewable energy resources for current and future generations is imperative. These valuable resources, including copper, uranium, lithium, cobalt and various other critical minerals, serve as key inputs to global manufacturing value chains.² However, their extraction exacts an environmental cost that is increasingly under scrutiny.³ Herein lies the potential for circular thinking⁴ to have a substantial impact, as stated by its proponents. By mitigating adverse environmental effects and capitalising on the economic potential of available resources, CE stands to address the regional imperatives of improving human well-being and fostering economic growth, as identified in the SADC Green Economy Strategy and Action Plan for Sustainable Development, especially when considering the region's burgeoning population growth.⁵

The reality is more nuanced than the optimistic outlook presented by CE proponents. Circular practices have already had both positive and negative effects on Africa's mineral supply chains. Electronic waste (e-waste) serves as a prime example, as the recovery of valuable minerals from e-waste has become a priority in the pursuit of a global CE model. Regions with advanced technologies and high electronic consumption are better equipped for safe mineral recovery, whereas technologically constrained regions, such as West Africa, face challenges in e-waste recycling. Implementing full-cycle circularity in mineral processing can, therefore, significantly reduce Africa's mineral requirements while placing certain economies – largely reliant on mineral extraction – at risk if certain value chain constraints are not adequately and timeously addressed.

The pathways toward achieving circularity, while promising, are undeniably complex. As a result, the primary aim of the research is to offer strategies to navigate these inherent complexities and establish thriving CE in the SADC region. This paper employs two diverse

1 A circular economy is an economic system designed to minimise waste and make the most of resources through strategies such as recycling, reusing, and remanufacturing, creating a closed-loop system; See Ellen MacArthur Foundation, "What Is a Circular Economy?", <https://www.ellenmacarthurfoundation.org/circular-economy/what-is-the-circular-economy>.

2 International Energy Agency, *The Role of Critical Minerals in Clean Energy Transitions*, Special Report (Paris: IEA, March 2022).

3 Mark Venables, "The Future for Sustainable Mining in Africa Lies in Circular Thinking", *IT News Africa*, May 4, 2022.

4 Circular thinking involves re-evaluating traditional linear thinking, where resources are extracted, used and then discarded, and instead focuses on designing systems that minimise waste, promote recycling, reusing and remanufacturing and encourage the continuous use of resources. See Ellen MacArthur Foundation, *Towards the Circular Economy: Vol. 1 – Economic and Business Rationale for an Accelerated Transition* (Isle of Wight: Ellen MacArthur Foundation, 2013).

5 Leo Komminoth, "Africa's Demographic Dilemma: Can Half a Billion Jobs Be Created by 2050?", *African Business*, March 1, 2023.

research methodologies – literature review and a participatory research approach involving field experts – which complement one another and contribute to a comprehensive understanding of the subject.

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The aim of the research is to explore and critically assess the relevance of the CE as concept and practice in the SADC region. This examination lays the groundwork to identify and highlight the emerging seeds of CE within Southern Africa. Subsequently, the paper dissects the barriers that impede the smooth integration of CE principles. Armed with this comprehensive understanding, our central objective is to devise strategic interventions. The aim is to foster budding CE initiatives within the region, while systematically dismantling the identified constraints hindering their full realisation.

Recognising the intricate nature of achieving true circularity, the research suggests the necessity of adopting a nuanced, region-specific approach to integrate circularity into new economic models. For policymakers and stakeholders invested in regional economic development and environmental sustainability, this paper serves as an illuminating guide to navigate the nuanced path toward integrating circularity into SADC's new economic paradigms.

Why a CE in SADC?

In sustainable development, the economy and finite ecology are interdependent, with ecological limits setting boundaries for economic activities. Economic systems, in turn, affect ecological resources. In response to this interdependence, the concept of CE emerged, with the aim of blending elements from both spheres. By closing loops and reusing resources, CE seeks to optimise resource utilisation while eliminating the need for extracting virgin resources.⁶ At its core, CE is underpinned by three fundamental principles that are orchestrated through strategic design:⁷

- the imperative to eliminate waste and pollution from value chains;

6 Frank Figge, Andrea Stevenson Thorpe and Melissa Gutberlet, "Definitions of the Circular Economy: Circularity Matters", *Ecological Economics* 208, no. 1-2 (March 2023).

7 Ellen MacArthur Foundation, "Eliminate Waste and Pollution", <https://www.ellenmacarthurfoundation.org/eliminate-waste-and-pollution>.

- the deliberate circulation of products and materials at their peak value; and
- the restoration of nature.

A purposeful transition to renewable energy sources and materials further fortifies the CE framework's robustness

A purposeful transition to renewable energy sources and materials further fortifies the CE framework's robustness. This signifies a paradigm shift from the traditional linear economy, where resources are extracted, used and discarded, often resulting in waste and environmental degradation.⁸ As a result, the CE concept is widely lauded as a comprehensive strategic approach for sustainable development.⁹ The compelling advantages of circularity have also driven a surge in academic publications and business discussions. Respected authors emphasise its potential alignment with UN Sustainable Development Goals (SDGs).¹⁰ The number of scholarly articles has risen from 99 a decade ago to over 4 000 by 2022. This has led to a marked increase in knowledge about CE,¹¹ consistently emphasising the following key CE drivers in the SADC context:

- social drivers;
- technological drivers;
- environmental drivers;
- economic drivers; and
- political drivers.

Social drivers

The global population is expected to reach 9 billion by 2050, with 2.5 billion in Africa.¹² This rapid population increase poses significant challenges related to effective waste management, specifically in response to the consequential rise in urbanisation.

8 Venables, "The Future for Sustainable".

9 Neal Millar, Eoin McLaughlin and Tobias Börger, "The Circular Economy: Swings and Roundabouts?", *Ecological Economics* 158, no. 12 (April 2019): 11-19.

10 Patrick Schröder, Kartika Anggraeni and Uwe Weber, "The Relevance of Circular Economy Practices to the Sustainable Development Goals", *Journal of Industrial Ecology* 23, no. 9 (February 2018).

11 Figge, Stevenson Thorpe and Gutberlet, "Definitions of the Circular".

12 Andrew Stanley, "African Century: A Demographic Transformation in Africa Has the Potential to Alter the World Order", International Monetary Fund, September 2023.

Of this anticipated population, 55% are projected to reside in cities.¹³ In Africa, the urban population could surge from 8.7% in 1990 to 22.3% by 2050.¹⁴ This rapid urbanisation, accompanied by improved living standards, will significantly impact resource consumption. The increase in population density also poses additional challenges related to the development of efficient waste management and transportation systems.¹⁵ This is particularly relevant in the SADC region, where unprecedented urbanisation has led to urban health crises, including disease outbreaks.¹⁶

Technological drivers

The success of CE, often associated with the potential of digitalisation to optimise resource use and promote sustainability,¹⁷ presents a unique set of challenges and opportunities in the African context.

The amount of waste generated across the continent annually is expected to surge from 174 million tonnes in 2016 to over half a billion tonnes by 2050.¹⁸ This is particularly concerning given that only 50% of the generated waste is collected and disposed of, leaving the other half unaccounted for and adversely affecting the natural environment. The high rate of dumping versus recycling has resulted in the continent now hosting 19 of the planet's 50 largest dump sites.¹⁹

One of the key contributing factors to this underdeveloped waste disposal system is the slow adoption of sustainable waste management practices, where much of the continent's technological structure is underdeveloped.²⁰ However, as noted in a recent GRID-Arendal report, this slow transition rate may present an opportunity. This is related to the fact that in wealthier regions most infrastructure has already been built without considering subsequent life cycles. Africa is therefore in the enviable position of incorporating CE principles into technologically advanced infrastructure from the outset.²¹

A compounding factor in Africa's technological advancement is its glaring e-waste management problem. Nigeria, for example, produced approximately 290 000 metric tonnes of e-waste in 2017 alone.²² Complicating the issue is the illegal import of

13 OECD Urban Studies, *The Circular Economy in Cities and Regions: Synthesis Report* (Paris: OECD Publishing, 2020).

14 Jamal Saghir and Jenna Santoro, *Urbanization in Sub-Saharan Africa: Meeting Challenges by Bridging Stakeholders* (Washington DC: Center for Strategic & International Studies, 2018), 1-7.

15 OECD Urban Studies, *The Circular Economy*.

16 Alhaji Aliyu and Lawal Amadu, "Urbanization, Cities, and Health: The Challenges to Nigeria - A Review", *Annals of African Medicine* 16, no. 4 (Oct-Dec 2017): 149-158.

17 Ellen MacArthur Foundation, *Towards the Circular Economy: Report* (Isle of Wight: Ellen MacArthur Foundation, 2013).

18 Andrew Tomita et al., "Exposure to Waste Sites and Their Impact on Health: A Panel and Geospatial Analysis of Nationally Representative Data from South Africa, 2008-2015", *The Lancet Planetary Health* 4, no. 6 (June 2020).

19 APET Secretariat, "What Waste Innovations for Africa's Waste Material Management?", AUDA-NEPAD (blog), July 19, 2021.

20 UN Environment Programme, "Harnessing Technology in the Circular Economy for Climate Action in Africa" (CTCN Knowledge Brief Series, UNEP, Nairobi, 2023).

21 GRID-Arendal, *Circular Economy on the African Continent: Perspectives and Potential* (Arendal: GRID-Arendal, 2021).

22 African Circular Economy Alliance, *Five Big Bets for the Circular Economy in Africa: Insight Report* (Coligny: World Economic Forum, April 2021).

second-hand electronics, with Nigeria receiving over 60 000 metric tonnes of used electronic equipment through its ports every year. Over a quarter of these illegally imported items are non-operational and dumped immediately.²³

Less than 1% of Africa's e-waste is collected through official recycling programmes.²⁴ The rest is often burned, releasing harmful minerals and chemicals into the environment, equating to 9.4 megatons of greenhouse gas (GHG) emissions annually.²⁵

Environmental drivers

Elevated environmental concerns regarding the potential impacts of climate change serve as a pivotal driving force of a transition toward circularity. This is understandable, as total GHG emissions are projected to rapidly increase over the coming decades, with global material usage expected to more than double from 2017 to 2060.²⁶ The well-established link between an increase in GHGs and climate change makes this surge in material consumption particularly concerning, as evident when considering that 2023 is now regarded as officially being the hottest year on record.²⁷ This is especially worrisome in sub-Saharan Africa, where climate change is projected to severely impact poverty levels²⁸ because of the region's heavy reliance on mineral extraction and agriculture.

The mineral extraction industry is known to create significant environmental impacts, with approximately 15% of South Africa's GHG emissions coming from the mining sector.²⁹ Reducing mining's negative impacts does not, however, lie in scaling down activities. The achievement of CE hinges on the mass rollout of renewable energy sources, which requires vast quantities of minerals such as copper, platinum and manganese.³⁰ It is therefore essential to explore and implement mining practices in SADC that have less negative impact on the environment.

The agriculture industry contributes roughly 23% to Africa's gross domestic product (GDP), with around 60% of the continent's economically active population involved in farming.³¹ This is particularly concerning in relation to the industry's high climate dependency. For example, an 8% yield reduction of staple foods such as maize and wheat is expected

23 African Circular Economy Alliance, *Five Big Bets*.

24 UNEP, *Towards a Circular Economy for the Electronics Sector in Africa: Overview, Actions and Recommendations*, Report (Nairobi: UNEP, 2021).

25 African Circular Economy Alliance, *Five Big Bets*.

26 OECD Urban Studies, *The Circular Economy*.

27 Mark Poynting and Erwan Rivault, "2023 Confirmed as World's Hottest Year on Record", *BBC News*, January 9, 2024.

28 Rodolfo Maino and Drilona Emrullahu, "Climate Change in Sub-Saharan Africa Fragile States: Evidence from Panel Estimations" (Working Paper 22/54, IMF, Paris, 2022).

29 Linda Godfrey et al., "Unlocking the Opportunities of a Circular Economy in South Africa", in *Circular Economy: Recent Trends in Global Perspective*, eds. SK Ghosh and SK Ghosh (Singapore: Springer, 2021).

30 Ross Harvey, "Mining for a Circular Economy in the Age of the Fourth Industrial Revolution: The Case of South Africa" (Policy Briefing 181, South African Institute of International Affairs, Johannesburg, June 11, 2019).

31 Lutz Goedde, Amandla Ooko-Ombaka and Gillian Pais, "Winning in Africa's Agricultural Market", McKinsey and Co., February 15, 2019.

in Southern Africa by 2050 due to climate change.³² This dependence, coupled with increased climate variance, consequently increases the likelihood of conflicts erupting over land and natural resources. Notably, it has been observed that higher temperatures have a direct correlation with an increase in conflict incidence in Africa, with a 1°C in temperature rise equating to a 4.5% increase in civil conflicts.³³

Economic drivers

Material consumption is expected to significantly increase in the coming decades.³⁴ This is especially concerning in the context of urbanisation, as material consumption within urban areas is forecasted to surge from 41.1 billion tonnes in 2010 to nearly 90 billion tonnes by 2060.³⁵ In light of the previously mentioned GHG emissions and material consumption link, the implications of these figures concerning the drive towards CE become strikingly evident.

Another economic incentive is CE's potential to increase competitiveness by achieving cost reductions through resource efficiency gains and the creation of innovative value streams from by-products and waste. For instance, the [European Environmental Agency](#) notes that strategies related to material reuse can generate a value of EUR³⁶ 85 million (about \$90 million) a year within the construction sector of Amsterdam alone.³⁷

Job creation is another crucial aspect of CE in the economic landscape. An economy promoting product-life extension through repair, maintenance and reuse tends to be more labour-intensive compared to the production processes of a linear economy.³⁸

Finally, as consumers become more environmentally conscious and demand products with a reduced environmental footprint, businesses are adapting to meet these expectations. This shift in consumer behaviour is compelling companies to integrate circular practices into their operations.³⁹

32 Victor O Abegunde, Melusi Sibanda and Ajuruchukwu Obi, "The Dynamics of Climate Change Adaptation in Sub-Saharan Africa: A Review of Climate-Smart Agriculture among Small-Scale Farmers", *Climate* 7, no. 11 (2019): 132.

33 Maino and Emrullahu, "Climate Change in Sub-Saharan".

34 OECD Urban Studies, *The Circular Economy*.

35 WEF, "This Chart Shows the Impact Rising Urbanization Will Have on the World", April 26, 2022.

36 Currency code for the EU euro.

37 European Circular Economy Platform, "Amsterdam Is Going Circular Smartly with 'Learning by Doing'", <https://circulareconomy.europa.eu/platform/en/good-practices/amsterdam-going-circular-smartly-learning-doing>.

38 Anders Wijkman and Mårten Berglund, *The Circular Economy and Benefits for Society: Jobs and Climate Clear Winners in an Economy Based on Renewable Energy and Resource Efficiency* (Rome: The Club of Rome, February 2017).

39 Carina Pasqualotto, Claudio Hoffmann Sampaio and Daniela Callegaro de Menezes, "Drivers and Barriers towards Circular Economy: A Systematic Review on Consumer Perspective in the Consumer Journey", *International Journal of Business and Management* 18, no. 6 (2023).

Political drivers

Policymakers are recognising CE's ability to assist in achieving a broad array of environmental, economic and social objectives while simultaneously mitigating some of the negative effects of infinite economic growth.⁴⁰ Several SADC countries, for instance, have incorporated the promotion of CE practices into their national environmental policies and legislative frameworks.⁴¹ Regional efforts include the 2017 African CE Alliance and the 2019 Durban Declaration⁴² for environmental sustainability. These national and supranational legal frameworks have proven effective, with almost 40% of respondents to a recent Organisation for Economic Co-operation and Development (OECD) survey noting that they act as important motivators for transitioning from a linear economy to CE.⁴³

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Why CE?

The prevailing answer to this question stems from the alignment of CE's acknowledged sustainability potential coupled with the drivers discussed above (see Figure 1). Yet critical scrutiny of the claims behind CE is vital to ascertain whether the concept can genuinely tackle complex environmental challenges while spurring sustainable economic development.

Critiquing CE

The second law of thermodynamics

A key concern surrounding the CE concept arises from the second law of thermodynamics, a scientific principle suggesting that all processes naturally increase disorder in the

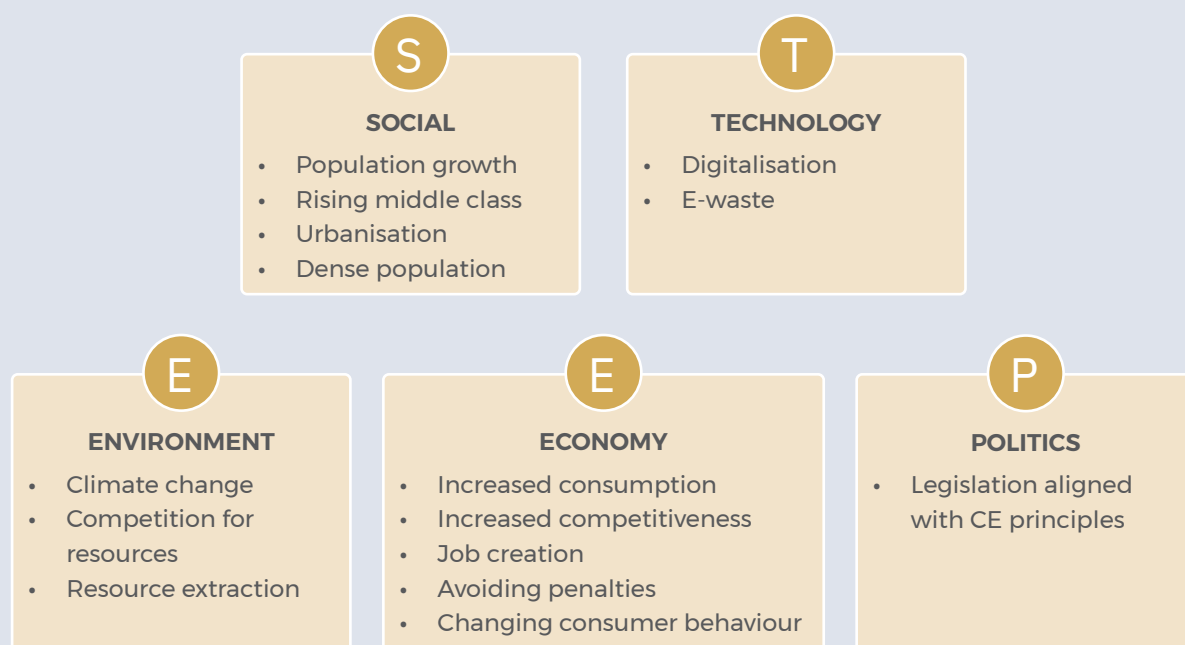
40 Ellen MacArthur Foundation, "Circular Economy in Africa: Policy", <https://www.ellenmacarthurfoundation.org/circular-economy-in-africa-policy>.

41 Kweku Attafuah-Wadee and Johanna Tilkanen, "Policy Approaches for Accelerating the Circular Economy in Africa", Chatham House, November 2, 2020.

42 African Ministerial Conference on the Environment, "Draft Durban Declaration on Taking Action for Environmental Sustainability and Prosperity in Africa" (African Ministerial Conference on the Environment, 17th Session, Ministerial Segment, Durban, November 13, 2019).

43 OECD Urban Studies, *The Circular Economy*.

Figure 1 STEEP analysis



Source: Compiled by authors

universe.⁴⁴ In the context of CE – which aims to reuse and recycle resources systematically – this law poses a challenge: the inevitable loss of energy as waste heat during recycling. Real-world complexities make complete reversibility and achieving zero waste practically impossible, requiring a continuous energy supply.⁴⁵

Challengers to this notion argue that the earth, as an open system receiving abundant solar energy, could use solar power for recycling and CE processes. While promising, widespread recycling with renewable solar energy demands significant efforts, including careful monitoring, retrieval and material processing, all requiring additional energy.⁴⁶

Material and energy dissipation therefore make fully reversible CE practices impossible. Two likely scenarios emerge: some waste production in linear segments deviating from perfect reversibility, or substantial energy inputs being necessary.⁴⁷ It is important to acknowledge, however, that while perfection may be elusive, the pursuit of sustainable CE remains crucial.

44 Jouni Korhonen, Antero Honkasalo and Jyri Seppälä, "Circular Economy: The Concept and Its Limitations", *Ecological Economics* 143 (2018): 37-46.

45 Christof Walter, "The Circular Economy in the Boundaries of the Second Law of Thermodynamics", LinkedIn, July 29, 2019.

46 Korhonen, Honkasalo and Seppälä, "Circular Economy", 37-46.

47 Walter, "The Circular Economy".

Economic challenges

Upon closer examination, a series of economic challenges also emerge, shedding light on the multi-faceted nature of the CE concept.

More of the same

While institutions like the European Commission position CE as a radical transformation, a critical examination raises questions about its depth in addressing fundamental challenges. Evaluating CE's potential for transformative change reveals its alignment with the current economic landscape. Prevailing perspectives of CE suggest sustainability can be achieved through market forces, technological advancements and policy adjustments within the neoliberal era. This approach prioritises incremental shifts over radical structural changes, which may hinder CE's transformative changes required for sustainable development.⁴⁸

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Unmitigated growth

Material consumption, as noted, is set to increase dramatically over the next few decades. This underscores a fundamental flaw in the prevailing economic development model, characterised by consumerism and mass production.⁴⁹ There is therefore an urgent and compelling need to thoroughly re-evaluate current growth paradigms, especially as the transition to a sustainable CE gains momentum.

Within this context, there is an argument for a departure from the singular pursuit of GDP growth in favour of adopting more comprehensive metrics for measuring societal well-being.⁵⁰ For instance, the 17 SDGs provide a broad and inclusive framework for guiding societal objectives. These goals encompass a range of aspirations, including the eradication of poverty and hunger, the reduction of inequality and the preservation and restoration

48 Thomas Siderius and Trevor Zink, "Markets and the Future of the Circular Economy", *Circular Economy and Sustainability* 3 (August 24, 2022): 1569-1595.

49 James D Ward et al., "Is Decoupling GDP Growth from Environmental Impact Possible?", *PLoS ONE* 11, no. 10 (2016).

50 Ward et al., "Is Decoupling GDP Growth".

of the environment and ecosystems. And while only one of these goals references GDP growth, it does so with the stipulation of ‘inclusive and sustainable growth.’⁵¹

The decoupling conundrum

Originally introduced by the OECD, the concept of decoupling aims to disentangle ‘environmental negatives’ from ‘economic positives’. Decoupling is defined as ‘the process of separating economic growth from associated negative environmental impacts, essentially achieving greater efficiency.’⁵² In practice, decoupling takes two forms:⁵³

- relative decoupling, which ensures that the growth rate of resource consumption remains below the economic growth rate, leading to improved resource efficiency; and
- absolute decoupling, where focus shifts to diminishing resource usage, driven by the growth rate of resource productivity surpassing that of the economy.

A comprehensive study into strategies for achieving absolute decoupling highlights the limitations of relying solely on relative decoupling driven by material inputs and energy consumption.⁵⁴ This underscores the need to prioritise absolute decoupling as a central goal to alleviate mounting environmental pressures. However, additional research reveals that disconnecting GDP growth from material and energy consumption is implausible.⁵⁵ This finding firmly establishes that continued GDP growth is unsustainable in the long run. Consequently, building policies based on the premise of attainable decoupling is misleading. Therefore, recognising these challenges and redefining growth objectives are crucial steps in steering us toward a more sustainable and inclusive future.

The dominance of the Global North

The dominance of the Global North significantly influences the prevailing narrative of CE, often side-lining viewpoints from the Global South. There is a conspicuous absence of articles originating from Africa, underscoring limited attention to the socioeconomic impacts of the CE in the South.⁵⁶ This oversight births unexplored prospects and challenges for the South, where industries rely heavily on resource-intensive practices like mining and agriculture. Transitioning to CE could disrupt these sectors, magnifying pre-existing inequalities.

51 Ward et al., “Is Decoupling GDP Growth”.

52 UNEP and International Resource Panel, *Decoupling Natural Resource Use and Environmental Impacts from Economic Growth* (Nairobi: UNEP, 2011).

53 UNEP and International Resource Panel, *Decoupling Natural Resource Use*.

54 Stefan Giljum et al., “Environmental Governance in the European Union: Strategies and Instruments for Absolute Decoupling”, *International Journal of Sustainable Development* 8 (2023).

55 Ward et al., “Is Decoupling GDP Growth”.

56 Pasqualotto, Sampaio and Menezes, “Drivers and Barriers”.

The dominant narrative is also significantly influenced by the priorities of the North, which may not resonate with the challenges encountered by regions such as SADC. Concerns like raw material scarcity might not hold the same weight as more critical matters, such as poverty eradication and job creation, in the SADC framework. The CE concept encounters added intricacies in SADC, where Indigenous circular practices are interwoven with nature. These valuable Indigenous insights often remain unnoticed. To cultivate an inclusive and sustainable global CE narrative, it is crucial to comprehend the repercussions of CE transformation in diverse contexts. Amplifying the voices of the Global South is thus indispensable.

Defining CE

There is no universally agreed-upon definition of the CE concept. This creates challenges for stakeholders – and could potentially lead to disagreements – as there are differing interpretations of what CE entails. Regional variations can add another layer of diversity in how different stakeholders perceive CE.⁵⁷

With this context in mind, Figge and Thorpe propose four critical attributes for a forward-looking understanding of CE.⁵⁸

- CE involves reusing resources in closed loops, eliminating the need for new resource extraction.
- CE focuses on optimising the flows and direction of resources.
- CE operates across different levels, each with its own logic. Resource circularity is observable at a higher level, such as within groups of companies or industries, supported by activities such as recycling and remanufacturing at a lower level. This creates a multi-level circular approach.
- Because of thermodynamics' limitations and the potential for human error, achieving 'perfect' resource circularity is unlikely. Therefore, various approaches will be needed to effectively reduce economic resource use to a sustainable level.

Considering the dominance of the Global North and unique concerns in the SADC region, this report suggests a fifth attribute: contextual sensitivity. Thus, a more nuanced understanding of the CE concept takes shape. CE is a multi-level resource use system – sensitive to its contextual implementation – striving toward the complete closure of all resource loops while utilising recycling and other means of resource flow optimisations as supporting regenerative practices.

57 Julian Kirchherr, Denise Reike and Marko Hekkert, "Conceptualizing the Circular Economy: An Analysis of 114 Definitions", *Resources, Conservation and Recycling* 127 (December 2017): 221–232.

58 Figge, Stevenson Thorpe and Gutberlet, "Definitions of the Circular".

The term 'striving' is intentionally included to emphasise that, although the ideal concept involves fully closing all resource loops, the realistic recognition is that some use of virgin resources is inevitable. This nuanced description broadens the understanding of the CE concept, recognising inherent limitations and forming the basis for our analysis.

Viable pathways to circularity

The following is based on insights derived from the participatory research approach undertaken with field experts. This approach used disparate yet interlinked futures research methodologies, specifically the 7 Questions,⁵⁹ Causal Layered Analysis⁶⁰ and Three Horizons⁶¹ methods. The objective is to gain a holistic understanding of both the enablers and barriers to CE in the SADC context.

As pertains to enablers, existing 'seeds' of circularity in the SADC context must be explored. 'Seeds' refer to initiatives – whether social, technological, economic or related to ways of thinking or doing – that exist at least in prototype form.⁶² These 'pockets of the future' are observable practices, ideas or elements that are currently rare and insignificant but have the potential to become more prevalent and impactful over time.⁶³

Green industries, waste management and renewable energy

Prioritising recycling and material reuse fosters the emergence of green industries, stimulating entrepreneurship and innovation, which inevitably leads to job creation. Leveraging existing informal recycling systems provides the basis for the development of more formalised waste management systems, while promoting sustainable practice holds the potential to address energy poverty and reduce GHG emissions.

The energy web chain, an open source blockchain network, serves as an example in the context of renewable energy. The network allows for peer-to-peer energy market transactions.⁶⁴ It was created to encourage renewable energy use through the creation of a decentralised marketplace linking energy sellers and buyers. It achieves this by connecting institutional energy providers with various users, including households and businesses. Its aim is to shift from separate power systems to a shared network, promoting a more transparent and efficient global energy grid.⁶⁵

59 Helen Shaw, "7 Questions Futures Technique", gov.uk (blog), May 1, 2018.

60 Sohail Inayatullah, "Causal Layered Analysis: Poststructuralism as Method", *Futures* 30, no. 8 (1998): 815–829.

61 Bill Sharpe et al., "Three Horizons: A Pathways Practice for Transformation", *Ecology and Society* 21, no. 2 (2016): 247.

62 Elena M Bennett et al., "Bright Spots: Seeds of a Good Anthropocene", *Frontiers in Ecology and the Environment* 14, no. 8 (October 2016): 441–448.

63 Greg Githens, "What Are Pockets of the Future?", LinkedIn, September 4, 2019.

64 Jennifer Runyon, "EWF Launches World's First Open Source Blockchain for the Energy Industry", *Renewable Energy World*, June 21, 2019.

65 Tokenicer, "What Is Energy Web Token? (EWT Token) – The Decarbonization Standard", *Future Citizen*, October 9, 2023.

Sustainable agriculture and food systems

Given the economic significance of agriculture in the SADC region and the projected global increase in food demand, particularly related to Africa's population boom, there is a critical need to reconsider our food systems in a more sustainable manner.⁶⁶ An illustrative example is the work conducted by the African Wildlife Foundation (AWF) in the Kilombero Valley of Tanzania. The AWF, in collaboration with the International Union for the Conservation of Nature's SUSTAIN-Africa initiative, addresses challenges such as poor harvests and deforestation resulting from the overexploitation of land. By providing practical training in climate-smart farming and offering improved drought-resistant varieties and technologies, the AWF supports local farmers in embracing innovative methods that boost yields while minimising impact on land and water resources.⁶⁷

Enhanced innovation and entrepreneurship ecosystems

Thriving incubation hubs and business acceleration programmes play a crucial role in identifying viable projects, products and services for scaling circular business models. For example, to catalyse the shift towards circularity in African cities, the [Accelerating Circular Economy Innovation in Africa project](#) was initiated. Its purpose is to cultivate an environment conducive to embracing CE concepts and innovative approaches. The project achieves this by providing support and upskilling opportunities for start-up companies and small businesses that exhibit promising contributions to circular practices. Coordinated by the International Council for Local Environmental Initiative Africa, the African Circular Economy Network (ACEN) and Stellenbosch University LaunchLab, the project received support from the Embassy of Finland in South Africa.⁶⁸

Integration of disruptive technologies

The Fourth Industrial Revolution introduces a spectrum of innovative technologies. These technologies have the potential to accelerate circularity by facilitating circular value chains, implementing provenance tools, introducing product passports and enhancing transparency solutions. One significant example demonstrating the impact of digitalisation on circular value chains within the African context is the [Circular Plastics Project](#). This multinational initiative is collecting plastic waste from low- and middle-income countries (including three African countries) and repurposing it into agricultural implements using 3D printing technology.⁶⁹

66 Desalegn Ayal, Ife-Oluwa Olawale and Olawale Olayide, "Review of Sustainable Agriculture and Food Systems in Africa", *African Journal of Sustainable Development* 11, no. 1 (2021): 37-52.

67 Fadhilli Njilima, "A Drought-Resistant Seed Boosts Sugarcane Yields, Stops Habitat Loss in Southern Tanzania", African Wildlife Foundation (blog), October 3, 2019.

68 ACE Africa, "Building Capacity for Circular Economy Innovation" (Digests from Six-Part Webinar Series, ICLEI Africa, Cape Town, February 8 - July 5, 2022).

69 Inès Magoum, "Africa: 3D Printing to Turn Plastic Waste into Agricultural Tools", *Afrik21*, September 14, 2021.

Collaboration, coordination and resource management

Collaborative efforts are poised to transform various sectors, encompassing education and training, policy harmonisations, financing, innovation and technology transfer, regional market development and resource management. These endeavours hold the potential to cultivate a harmonised approach to advancing CE practices in the SADC region. Increased knowledge sharing in CE and ongoing research at the tertiary level of academia are expected to facilitate a positive systemic shift in both human and institutional capacity.

A recent example of successful collaboration is the ACEN partnership with [Trinomics B.V.](#) to establish the [ACEN Foundation](#). This strategic partnership capitalises on the strengths of each partner, with both implementing circular principles in Africa. The combined efforts of ACEN and the ACEN Foundation are anticipated to generate a significantly greater impact than could be achieved through individual organisational endeavours.⁷⁰

In resource management, [Minespider](#) is an example of an innovative initiative dedicated to addressing conflict minerals globally. Its blockchain-based platform enables the traceability of mining activities and raw material movements by creating digital product passports. These passports contain vital sustainability, provenance, due diligence and carbon emissions data, secured via blockchain technology and linked to products through quick response (QR)⁷¹ codes.⁷² This approach allows stakeholders to easily trace the origins of materials, marking a significant step toward transparent and accountable resource management.

Labour market transformations

The adoption of CE principles is set to redefine the labour market landscape by generating fresh job prospects, requiring training and education in sustainability-related fields and instigating changes in business priorities and focus areas. This can be a daunting undertaking for entrepreneurs looking to enter the CE arena. An initiative effectively

The adoption of CE principles is set to redefine the labour market landscape by generating fresh job prospects, requiring training and education in sustainability-related fields and instigating changes in business priorities and focus areas

70 African Circular Economy Network, <https://www.acen.africa/>.

71 A QR code is a form of barcode designed to store data that can be read by digital devices, such as smartphones. In this context, the stored information may include product details such as origins, carbon footprint, consumption patterns and more.

72 Supply Chain Movement, "[Supply Chain Start-Up in the Spotlight: Minespider](#)", December 16, 2022.

addressing this knowledge gap is the global circular business start-up toolkit introduced by [Youth Business International](#) (YBI).⁷³ A notable success story arising from the YBI fold is BioMec Prosthetics in Mozambique, which designs and produces prostheses from recycled plastic waste.⁷⁴

Developing Material Flow Analysis and a Natural Capital Accounting system

Establishing a robust Material Flow Analysis (MFA) and a Natural Capital Accounting system (NCA) plays a pivotal role in facilitating CE. MFA quantifies material flows, providing valuable insights for decision-making, policy interventions and environmental protection. It informs the development of CE strategies by planning effective reuse and recycling systems.

An example is the MFA conducted by the South African Department of Science and Innovation. The analysis was based on (at the time) the most recent and robust data from 2017. In collaboration with the University of Cape Town and the [BOKU University team](#) from Vienna, this project, undertaken within the framework of the Waste Research, Development and Innovation Roadmap, adapted BOKU's established accounting and calculation framework. The aim was to capture and describe the circularity of South Africa's national economy within its specific context.⁷⁵

On the other hand, an NCA quantifies and attributes economic values to natural resources such as forests, water, minerals and biodiversity. Assigning economic values to these resources streamlines their integration into CE, facilitating informed decisions regarding their sustainable use and conservation. This system enhances resource efficiency, promotes cleaner production solutions, informs policy and regulatory frameworks and empowers decision-making based on evidence-backed data. It also aids in identifying priority areas for intervention, setting targets for resource efficiency and conservation and monitoring progress towards sustainability goals. Most importantly, an NCA lays the foundation for sustainable investment decisions by providing a standardised and comparable framework for assessing the natural capital risks and opportunities associated with various investment options. A key example is Statistics South Africa's (Stats SA) recently published [10-year strategy](#) for advancing NCA in South Africa. The purpose of the strategy is to focus the efforts of Stats SA, relevant departments and other institutions on developing priority natural capital accounts to inform South Africa's sustainable development policy objectives.⁷⁶

73 Catherine Wijnberg and Bridget Wijnberg, "[Harnessing the Power of Circular Business for an Abundant and Sustainable Africa](#)", Fetola, April 21, 2023.

74 Youth Business International, "[Reconciling Profit with Purpose: Young Green Entrepreneurs Create Inclusive Green Jobs for the Future](#)", November 10, 2021.

75 H von Blottnitz et al., "[Challenging but Promising: South Africa's Transition Towards a Circular Economy](#)" (Briefing Note, University of Cape Town and University of Natural Resources and Life Sciences, Vienna, June 2021).

76 Stats SA, "National Natural Capital Accounting Strategy", https://www.statssa.gov.za/?page_id=14714.

De-risking investments and improved access to financial resources

Transitioning towards CE in the SADC region presents both opportunities and financial risks. Encouraging widespread adoption requires a multi-faceted approach, including de-risking investments and improving access to financial resources. By mitigating potential risks and uncertainties, the SADC region can establish an environment that allows CE projects to flourish. Additionally, to effectively address the learning curve associated with capacity building, both human and institutional, innovative financing schemes are required.

Encouraging widespread adoption requires a multi-faceted approach, including de-risking investments and improving access to financial resources

Take for example the South African CE Demonstration Fund, implemented through Circular Innovation South Africa, by the government of South Africa. This fund aims to demonstrate proven CE interventions, such as innovative technologies, process improvements and social innovations, which have not yet achieved scale or impact in South Africa.⁷⁷

Innovative monetary reward systems

Innovative monetary systems play a crucial role in promoting sustainable practices and incentivising waste management. A notable example is the Packa-ching project, spearheaded by Polyco, a South African non-profit organisation committed to enhancing plastic packaging collection and recycling. The Packa-ching initiative introduces an innovative approach to waste management by incorporating a mobile kiosk. This kiosk serves as a collection point where people can bring their household recyclables for compacting and recycling. What sets this project apart is its integration of an instant cashless payment system directly to the contributors' phones.⁷⁸

Shift in consumer needs and new ownership models

Although not yet noticeable at scale, changing consumer needs are anticipated to drive the emergence of innovative business models. These include sharing platforms and product-as-a-service, redefining consumer behaviours toward access-oriented

77 South African Government, Department of Science and Innovation, "Science and Innovation Launches Initiatives to Accelerate the Development of South Africa's Circular Economy", Media Statement, May 12, 2023.

78 Georgina Crouth, "Packa-ching Initiative Gives Informal Settlement Residents a Cash Incentive to Recycle Waste", *Daily Maverick*, June 14, 2023.

consumption, propelled by the growing awareness of sustainability. Simultaneously, the transition toward CE is expected to give rise to diverse ownership models like collaborative consumption, extended producer responsibility (EPR), community ownership, closed-loop production and materials-as-a-service (MaaS).⁷⁹

The MaaS concept involves transferring the right to use a resource instead of owning it. This has the potential to generate royalties supporting mining communities and funding mine rehabilitation. Another anticipated system change is the increasing development of CE business models across various products and services, likely accelerating the creation of bankable products with potential endorsement from the African Continental Free Trade Area and other regional trade value chains.

An illustration of these shifts is [Hello Tractor](#), an agricultural technology company based in Nairobi, Kenya. This platform aims to enhance food and income security across sub-Saharan Africa. It addresses limited resources in agriculture by providing access to shared agricultural equipment through a farm equipment-sharing application. This application connects tractor owners with smallholder farmers in need of tractors. Recently, John Deere, the world's largest agricultural equipment manufacturer, invested an undisclosed amount in this firm, highlighting its promise of scalability.⁸⁰

Barriers and challenges to circularity in SADC

Lack of a uniform and inclusive regulatory framework

Examining the SADC region's current enabling regulatory structure reveals the necessity of creating a uniform and inclusive regulatory framework for waste management policies and EPR, to promote CE transformations. The establishment of an EPR and CE platform was recently initiated by the SADC Business Council in collaboration with pertinent stakeholders. This platform brought member states together to discuss cross-sector policies, identify and invest in potential regional value chains, construct infrastructure like recycling facilities and integrate informal waste collectors into formal waste management, to give the region a comparative advantage. A regional strategy for creative startups, which promotes creativity and facilitates an ecosystem of circular business models, is critical for scaling up circular solutions. The challenge is that some SADC governments do not prioritise the CE initiatives required to meet targets. Advocating for stronger political commitment to CE at the continental, regional and national levels is therefore essential.

79 ACEN, "Advancing the Circular Economy: WCEF and Materials-as-a-Service" (Virtual Workshop, August 10, 2023).

80 Catherine Cheney, "How an NGO Helped Hello Tractor Attract Its Biggest Investor", *Devex*, March 30, 2023.

Knowledge disparities

The diverse interpretations of CE within SADC member states pose a significant obstacle. The imminent demand for professionals with circular skills in multiple countries underscores the necessity to standardise these skills, making it an inevitable requirement in the region's workforce development efforts. To effectively confront this challenge, it is imperative to establish a unified regional framework for CE education and awareness. This framework must harmonise with the AU and SADC Roadmaps,⁸¹ ensuring a consistent and coordinated dissemination of knowledge. Limited understanding of CE concepts in the SADC supply chain is a barrier. To overcome this challenge, policies should focus on integrating CE principles into existing educational curricula.

Negative perceptions and resistance to change

Resistance to adopting CE principles, driven by biases and concerns about recycled goods' quality, is a noteworthy challenge. Policies aimed at overcoming this resistance should implement measures to challenge negative perceptions, promote local products and incentivise businesses aligning with CE principles. The Green Growth programme in Tanzania, for instance, fosters links between farmers and markets, ensuring increased returns. It thereby reinforces the incentive for farmers to invest in the preservation of the natural environment.⁸²

Data-driven decision-making

Inadequate data concerning essential aspects of CE impedes informed decision-making for local government CE initiatives. This includes virgin raw material extraction, material productivity, product design, innovation and regenerated natural capital percentages (eg, reclaimed soil and increased water tables), waste generation and recycling rates. Addressing this challenge will require policies centred on establishing robust data collection and analysis systems. It is crucial to align these policies with [International Organization for Standardization](#) CE guidelines, facilitating the measurement of qualitative and quantitative indicators.

Policy recommendations

The challenges associated with achieving CE in the SADC region are evidently intricate and interwoven. This complexity requires a comprehensive approach that resolves existing issues without creating new ones. Therefore, it is crucial to note that the following policy recommendations must not function in isolation but rather work together, driving change

81 Roadmaps are strategic frameworks developed to guide countries in their transition from linear to circular economic models.

82 Njilima, "A Drought-Resistant Seed".

throughout the system. The subsequent sections discuss key areas identified in the research as demanding specific policy attention.

The challenges associated with achieving CE in the SADC region are evidently intricate and interwoven. This complexity requires a comprehensive approach that resolves existing issues without creating new ones

Regional collaboration and boundary erasure

The AU Office of Strategic Planning and Delivery and the SADC Secretariat Industrial Development and Market Integration Directorate (IDMID) should build upon the AU Commission's recently announced [Continental Circular Economy Action Plan for Africa](#) by collaborating, designing and implementing Regional and National Circular Economy Strategic Frameworks and Guidelines to facilitate the widespread adoption of CE practices by member states. Additionally, this directorate should develop sector-specific, costed action plans aligned with established strategies, such as industrial and green economy strategies, to harmonise efforts and maximise impact. Recent developments, notably the AU's completion of a continental roadmap slated for implementation in 2024 and the finalisation of SADC's regional roadmap in 2023, underscore the pressing need for harmonisation, identification and prioritisation of actions in the next two to three years.

As part of a commitment to regional collaboration and boundary erasure, SADC member states, through their departments of planning, monitoring and evaluation, should develop a measurable index and indicators that gauge the level of regional integration of CE achieved over time. This index can encompass factors encompassing economic, social and political integration to effectively measure and track progress toward a more integrated regional CE.

Empowering stakeholders and communities

SADC member states' departments of trade and industry should explore a collaborative effort involving SADC member states, such as the platform described by the Ellen MacArthur Foundation,⁸³ laying the groundwork for unified adoption of best practices across all member states.

As part of this transformative initiative, SADC member states' departments of planning, monitoring and evaluation should implement the Extended Producer Responsibility/

83 Ellen MacArthur Foundation, "Circular Economy".

Circular Economy Platform,⁸⁴ a regional showcase of best practices advancing EPR. This holistic strategy aims to drive the transition towards CE, ensuring sustainable practices and fostering innovation in product design and materials use across the SADC community.

To effectively monitor progress, SADC member states' departments of planning, monitoring and evaluation should establish a measurable target for a percentage increase in the development and adoption of circular products in the SADC region. This metric will serve as a clear indicator of progress in embedding circular principles within the regional economy.

Rethinking economic incentives

The IDMID should develop innovative fiscal and trade policies to fortify fit-for-purpose CE. These policies aim to unlock economic incentives and validate the economic feasibility of circular business models. Exploring tax incentives, grants, subsidies and low-interest loans can incentivise businesses while mitigating investment risks associated with recycling infrastructure and adopting sustainable practices. The implementation of such financial schemes will encourage and support businesses in adopting and sustaining CE initiatives.

The launch of the Africa Circular Economy Facility is expected to catalyse an increasing trend of circular products and services in the SADC region. This surge presents an opportune moment to bolster these fiscal and trade policies, leveraging the growing market for circular goods. As a result, the IDMID should prioritise the development of CE fiscal and trade policies while exploring financial schemes within the next three to five years. These initiatives will play a crucial role in de-risking investments for recycling infrastructure and promoting the adoption of sustainable practices.

To effectively monitor the progress of these initiatives, SADC member states' departments of planning, monitoring and evaluation should track the increase in the number of businesses in the SADC region adopting CE practices by the end of the given time.

Balancing innovation and existing indigenous solutions

It is important to recognise the pivotal role of industrial development and market integration in fostering a sustainable CE in the SADC region. The IDMID, working in collaboration with the SADC Directorate for Science, Technology and Innovation and specialised academic or research institutions, should drive the establishment of a framework that harmonises innovation and Indigenous solutions, promoting a sustainable CE.

84 Africa RISE, "Extended Producer Responsibility /Circular Economy Platform: Transforming through Circular Economy", <https://www.eu-africa-rise.com/article/the-extended-producer-responsibility-circular-economy-platform-transforming-through-circular-economy>.

The Industrial Development and Market Integration Pillar of the Regional Indicative Strategic Development Plan (RISDP) 2020–2030⁸⁵ aligns closely with the objectives of fostering CE by focusing on industrial development, market integration and value addition to regional resources. Simultaneously, collaboration with the SADC Directorate for Science, Technology and Innovation will leverage technological advancements and innovative practices, aligning them with sustainable principles endorsed by the Industrial Development and Market Integration Pillar.

Fostering partnerships between the SADC Secretariat and specialised academic or research institutions, as envisaged in the RISDP, will leverage collective expertise to develop CE in the region.

Re-conceptualising waste management and education

The SADC Social and Human Capital Development Directorate should revamp educational curricula throughout member countries, deeply embedding CE principles, research and innovation at the core of learning ecosystems over the next three to five years.

This endeavour concurrently should seek to secure dedicated funding from government agencies to fuel research and development (R&D) initiatives concentrated on CE solutions. The emphasis should be on integrating these principles at technical and vocational education and training colleges, to fortify practical application. To ensure the success of this initiative, the directorate will leverage its expertise in educational policies and foster collaboration among various entities. Coordinated efforts will involve educational boards, national education ministries, research institutions, funding bodies, industry partners and international organisations.

Key performance indicators will measure the impact of these efforts, tracking the percentage of revised curricula that effectively integrate CE principles, the number of funded collaborative R&D projects and the successful implementation of circularity-focused educational programmes across member countries.

Promoting fit-for-purpose CE

The potential of circular thinking to reshape the region is evident, yet formidable challenges persist. The scarcity of strategic initiatives that drive true systemic change highlights the need for the SADC region to move beyond isolated efforts and embrace a holistic, contextually sensitive approach. Designing and implementing CE principles and practices require the consideration of various factors, including resource availability, cultural norms, regulatory frameworks and market dynamics. There is a genuine need for the increased

85 SADC, *Regional Indicative Strategic Development Plan 2020–2030* (Gaborone: SADC, October 2020).

use of innovative research methods aimed at enhancing anticipatory governance through the involvement of heterogeneous groups of stakeholders. To bridge this gap, the field of futures/strategic foresight potentially plays a crucial role in a comprehensive and systematic evaluation of a fit-for-purpose CE. In addition, future research initiatives should embed system-strengthening approaches among the variety of disparate and disjointed CE projects. This will allow for a greater understanding of possible shortcomings in current approaches to CE practices and advance the evolution of applied CE principles appropriate to the African context.

The scarcity of strategic initiatives that drive true systemic change highlights the need for the SADC region to move beyond isolated efforts and embrace a holistic, contextually sensitive approach

As we navigate this transformative journey, let us draw inspiration from the wisdom of an African proverb: 'If you want to go far, go together.' By collaborating and leveraging our collective strengths, we can chart a sustainable and prosperous future along the circular path that lies ahead.

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