Transformational entrepreneurship in Africa's circular plastic economy

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Chapter 14

Transformational Entrepreneurship in Africa's Circular Plastic Economy

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Abstract

Plastic pollution is a major 21st Century challenge, posing significant environmental and health problems which are becoming increasingly intractable. In Africa, this challenge is exacerbated by the lack of robust infrastructure and waste management systems. However, over the past decade, there has been a surge in the number of entrepreneurs embracing digital tools and technologies to develop circular plastic economy innovations. This rapid increase is driven by the rise in number of technology hubs, increased access to capital, enabling policies, increased access to smartphones with internet connectivity, and a young demographic profile. This chapter highlights a selected number of circular economy innovations. These include WeCyclers in Lagos, Nigeria, which engage residents of low income densely populated, urban areas by incentivising them to recycle their waste and Yo - Waste in Uganda, a technology waste management company focusing on waste, recycling and smart city solutions. These start-ups are creating social, economic, and environmental value by going out of their way to create new ideas, approaches, and interventions for plastic waste management in Africa. This chapter draws on case studies from across the continent to provide insights on the drivers and challenges of these transformational entrepreneurs as well as well as recommend a pathway for growth.

Keywords

Circular economy; Plastics; Africa; Digital innovations; Emerging Technologies; Circular Plastics Economy; Sustainable Development

Learning outcomes

By the end of this chapter, the reader should be able to understand how to apply transformational entrepreneurship in the circular economy.

14.1 Introduction

Plastic pollution has become a pressing environmental issue, as entrenched linear production systems and associated consumption habits continue to drive an increase in plastic production globally. This trend has resulted in a significant amount of plastic waste, with more than 12 million tonnes of plastics leaking into the world's oceans annually, posing severe risks for marine life (Jambeck et al., 2015). Moreover, single-

use plastics, which constitute 50% of generated plastic waste, have contributed significantly to the plastic pollution problem (Grodzińska-Jurczak et al., 2022; Phillips, 2022).

The concept of the circular economy, which advocates for reducing, reusing, recycling, redesigning, remanufacturing, and recovering, has gained increasing attention globally, including interest from governments and businesses(Korhonen et al., 2018). The circular economy has been touted as a viable intervention for the plastic challenge (Kirchherr et al., 2017; Geissdoerfer et al., 2017). Its key approaches are expected to significantly contribute to better management of the high volumes of waste in the ecosystem, thereby realizing lasting productivity and economic growth, otherwise described as the "circular advantage." In other words, the circular plastic economy (CPE) is widely viewed as a sustainable option for tackling the plastic challenge. The CPE approach induces a more competitive, adaptive, regenerative, and resource-efficient plastics value chain. Moreover, it provides a good model for resolving the different environmental and ecological concerns caused by inefficient plastic waste management, while recovering significant value that has been lost in the traditional linear plastics value chain.

Governments in the Global West are increasingly embracing the circular transition, but progress by African governments has been sluggish (Oyinlola, Schröder, et al., 2022). As a result, the private sector has emerged as a significant player in the African context (Kolade et al., 2022). With a dearth of adequate waste management infrastructure prevalent in Africa, opportunities for the use of digital technology in waste management, especially in the informal sector, have gained traction in recent years. This has led to start-ups springing up to create intelligent solutions for waste management, including optimized waste collection, promoting transparency, tracking waste flows, remote sensing, and other approaches(Oyinlola, Schröder, et al., 2022). These start-ups are creating social, economic, and environmental value by developing new ideas, approaches, and interventions for plastic waste management in Africa. The activities of these start-ups can be classed as transformational entrepreneurship, as they not only use digital technologies for financial incentives but also create innovative solutions that transform societies and positively impact people's lives (Jones & Maas, 2019). This is in line with the cardinal objectives of transformational entrepreneurship as an endeavour that goes beyond the traditional objective of economic value creation to social and economic impact. In this regard, the contributions of Africa's circular economy startups align with the global agenda on sustainability transitions, in particular the growing importance of circular production and consumption. To underline their transformative impact, African circular innovators and entrepreneurs are creating an ecosystem effect that has brought other multi-sectoral stakeholders to the table in the synergistic agenda to accelerate transition to a circular economy on the continent. Despite their significant, and increasing, contributions to the sustainability agenda on the continent, the activities of transformational entrepreneurs in Africa are not well documented. Thus, this chapter aims to contribute to bridge the

gap by providing insights into the drivers and challenges of these transformational entrepreneurs. More importantly, the chapter contributes to the literature on transformational entrepreneurship by highlighting the mechanisms through which entrepreneurs drive sustainability transitions on the African continent.

The chapter is structured as follows: Following the introduction above, the chapter presents a conceptual framework, followed by an outline of the method used in this study. This is followed by case studies from across the continent that highlight some of the factors catalysing the rise of transformational entrepreneurs in Africa. Finally, the chapter concludes with recommendations for transformational entrepreneurship in Africa's CPE and a summary of the study's findings.

14.2 Conceptual framework

The chapter aggregates and integrates ideas from the interrelated concepts of transformational entrepreneurship (Maas et al, 2019; Raten, 2022; Wainwright et al, 2023), sustainability transitions, and a triple-layered model of economic, social and environmental value creation (Kolade et al, 2021). Transformational entrepreneurship highlights the deployment of creative innovations to solve societal problems. Concomitant with the fundamental idea of transformation is change. In other words, transformational entrepreneurs are those entrepreneurs who deploy different combinations of technological and business model innovations to change undesirable situations in society to desirable ones. Some scholars have therefore investigated the transformative impact of entrepreneurship in conflict settings, where it has been observed that increasing, and mutually beneficial, economic transactions among previously hostile communities helped to lower outgroup prejudice and in-group bias, thereby fostering peace (Tobias et al, 2013). Others have looked at the transformative and emancipatory impacts of entrepreneurship among the displaced and the dispossessed, where entrepreneurial opportunities and innovative recombination of limited resources have precipitated socio-economic changes through the realisation of new economic opportunities, livelihood outcomes, and the expansion of human capabilities (Al Dajani, 2015; Luseno & Kolade, 2022).

One of the major societal challenges of the 21st century is plastic waste pollution, among other pressing environmental challenges. Much of the extant literature on sustainability transitions have focused on the imperative of technological innovations, international policy commitments and public awareness campaign to drive transition to a new era of sustainable production and consumption. Fewer studies have addressed the market imperative of sustainability transitions, and how entrepreneurial interventions can contribute to this, especially in emerging economies, where markets and policies are in a continual state of flux, and there are bigger opportunities to drive change.

The entrepreneurial process entails three intertwined components: opportunity recognition, value creation, and value capture. Entrepreneurial opportunity recognition refers to the act of identifying and assessing circumstances where novel products and services can be introduced using innovative approaches, techniques, and mechanisms (Eckhardt and Shane, 2003; Phillips and Tracey, 2007). Value creation encompasses the entrepreneurial process of leveraging opportunities to introduce new products and services to the market, with the aim of delivering value to stakeholders. This value creation can manifest in social, environmental and economic forms (Atiase, Kolade and Liedong, 2020; Kolade et al., 2021). Value capture refers to the ability of firms and entrepreneurs to retain or own a portion of the value created for stakeholders. This can be achieved through a wide range of strategies, including pricing, intellectual property rights, royalties, and economies of scale, among others.

We bring the preceding paragraphs together to propose a conceptual framework to highlight the mechanisms and processes through which entrepreneurs drive transformative transition from linear to circular plastic economy (see figure 1). These are mapped through the three-stage process of entrepreneurial action: opportunity recognition, value creation, and value capture. At the first stage of opportunity recognition, innovative entrepreneurs recognise new opportunities in the global drive towards sustainability, increasingly backed by government policies, international conventions and growing public sentiments that make linear products less socially acceptable and therefore less marketable in the medium to long term. Policies around extended producer responsibility and green tax also make linear products potentially less profitable in the long term. Circular entrepreneurs therefore sense the opportunities to be early entrants into circular products, which are expected to gain increasing traction in the future. This is followed by the value creation stage, through which circular entrepreneurs deploy digital and business model innovations to create and promote new circular plastic products across the entire phases of the plastics value chain, from design to production to use and end of life (Dicuonso et al, 2022). These products are in response to changing consumer tastes and demands informed by sustainability transition drives across the globe. Circular entrepreneurs and startups also create new and better income opportunities for informal waste pickers, with additional opportunities for financial visibility through the deployment of Industry 4.0 technologies like Blockchains. Finally, at the value capture state, circular entrepreneurs and firms retain economic value through, among others, revenue accrued from innovative re-use of previously discarded products; profits realised via collaborative consumption of otherwise idle products; and through capture and retention of new consumers transitioning from linear to circular products. They also acquire social capital through interactions with new stakeholders and consumers in the circular plastic economy.

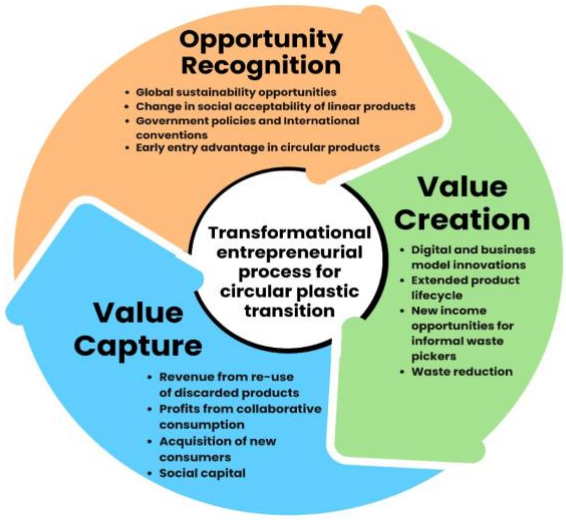

Figure 14.1: Transformational entrepreneurial process for circular plastic transition

14.3 Methodology

This chapter adopts a comparative case study approach as the analytical framework. This approach is well-suited for analysing and synthesizing the similarities, differences, and effective practices observed across the selected cases presented in Appendix 1 (a more indepth description of some of the cases can be found in (Oyinlola, Kolade, et al., 2022) As noted by Goodrick (2014) comparative case studies are particularly beneficial for understanding and explaining how context influences the success of specific interventions, projects, or programs.

The specific objective of this study is to produce knowledge that can be used to generalise questions and determine relevant lessons from existing examples of transformational entrepreneurship in Africa's CPE. To achieve this objective, we mapped the existing innovation initiatives and entrepreneurial models in Africa that apply digital technologies to address plastic waste in Africa's CPE.

We sent out electronic surveys to the 39 initiatives identified (see Appendix 1), of these, 17 organizations completed the survey, providing valuable data that were analysed using a comparative case study approach. The survey included questions related to the organizations' objectives, target market, business models, and challenges encountered in implementing their initiatives. The survey data were analysed using a thematic approach to identify common patterns and themes across the cases. These were further categorised into opportunities and challenges. We also conducted in-depth interviews with selected organizations to gain a more comprehensive understanding of their initiatives and the factors that contributed to

their success or failure. More details about the methodology can be found in (Oyinlola, Kolade, et al., 2022).

Overall, the comparative case study approach adopted in this study provided a robust data to unpack the complex and dynamic context of transformational entrepreneurship in Africa's CPE. It enables us to identify and synthesise effective practices and lessons learned that can inform policy and practice in this important area.

14.4 Results and Discussion

14.4.1 Case Studies

The discussion draws on case studies of various organisations presented in Appendix 1, which include Mr Green Africa in Nairobi, Kenya, which leverages technology and enables waste collectors to be part of the value chain; Pakam Technology, in Lagos, Nigeria a marketplace for waste recycling in Nigeria which connects waste generators to waste collectors in real-time and Yo - Waste in Uganda which is a technology focussed waste management company focusing on waste, recycling and smart city solutions. These waste management initiatives utilise a combination of web, mobile app, SMS, and IoT technology to automate and digitize the waste recovery process. Through their activities, which fills the gap of inadequate infrastructure, these entrepreneurs are making a significant impact in society by mitigating the health and environmental hazards posed by inappropriate disposal of waste. The primary focus is on incentivizing households and businesses to recycle and reward them with redeemable points, cash, or mobile data. In addition to this, the initiatives leverage technology to teach users how to properly separate waste for efficient processing and connect waste collectors with households and businesses through digital platforms. Most organisations analysed in this study function as a multi-sided platform (MSP). MSPs are characterized by the existence of two or more distinct customer groups who are directly affiliated with the platform and can interact directly with one another (Hagiu & Wright, 2015; Trabucchi & Buganza, 2020). For example, WeCyclers functions as an MSP, facilitating connections between subscribers who generate plastic waste, franchised waste collectors, and uptakers who purchase and recycle plastics.

14.4.2 Opportunities

The circular plastic economy presents significant opportunities for transformational entrepreneurship in Africa. For example, wecyclers and Recycle points are empowering informal and unskilled workers with opportunities to engage in enterprise that not only generates income but also impacts society. This is facilitated by digital technology and suitable business models which enhances creating and capturing value, leading to job creation, innovation, and sustainable development. The emergence of technology hubs across the continent (Atiase et al., 2020), coupled with increased access to capital (AVCA, 2022), has contributed to the growth of the ecosystem. Regulatory and demand advantages play a crucial role in determining the

success of entrepreneurs in the circular plastic economy (Losacker & Liefner, 2020). However, most entrepreneurs lack these advantages, limiting their contribution to the transition. This section will explore the opportunities and drivers for transformational entrepreneurship in the circular plastic economy in Africa.

The growth of transformational entrepreneurship in Africa's circular plastic economy is driven by several factors. Firstly, the emergence of technology hubs across the continent within the last decade has provided young people with the opportunity to immerse themselves in technologies that result in innovations supporting development. These hubs are instrumental in building digital innovation start-ups and a robust digital ecosystem where entrepreneurs can learn from as well as share ideas with like-minded innovators. Furthermore, tech hubs offer much-needed reliable internet access and electricity(Giuliani & Ajadi, 2019). This Tech hubs offer significant opportunity for incubating and accelerating transformational entrepreneurs in Africa's CPE.

The growth of the circular plastic economy in Africa presents numerous opportunities for entrepreneurs, such as job creation, innovation, and sustainable development. Digital technology has increased the efficiency and effectiveness of the waste management sector, which has opened new opportunities for entrepreneurs. The inadequate waste management infrastructure that is prevalent in Africa has resulted in new opportunities for utilizing digital technology in waste management, particularly in the informal sector. This has led to the rise of transformational entrepreneurship in the circular plastic economy, offering new opportunities for using digital technology in waste management (Kolade et al., 2022). However, there is still significant scope as most of the entrepreneurs are yet to be financially sustainable (Oyinlola, Schröder, et al., 2022). To scale up and increase profitability, these entrepreneurs must provide increasingly significant network externalities. Start-ups like Yo Wastes and Recyclebot are in very early phases of development and need to expand their network, not just of subscribers, but also of collaborative partners to establish the necessary network effects required to develop and capture more value.

Digital platforms can also be used to establish virtual marketplaces for plastic waste management, connecting waste collectors to processors and purchasers of recycled materials. The effectiveness of these marketplaces is contingent on market regulation and support. Increased access to capital has played a significant role in the growth of the ecosystem. There has been an exponential increase in the volume of venture capital deals in Africa over the past 5 years, with 2022 predicted to have about 900 deals compared to 650 in 2021 and 319 in 2020. Similarly, there has been a similar exponential trend in the value of investment in African start-ups, which was US $0.3bn in 2017 and US $5.2bn in 2021 with 2022 predicted to be US $7bn (AVCA, 2022).

The African Union Commission recognized the potential of digital innovations to create jobs, address poverty, reduce inequality, and contribute to the Sustainable

Development Goals. In response, the Commission developed a comprehensive Digital Transformation Strategy for Africa, setting several specific targets for 2030 (African Union, 2020). Similarly, different initiatives have been implemented across Africa to leverage digital accessibility and affordability. These enabling policies across the continent are also catalyzing the growth of the emerging innovation ecosystem.

Africa's digital infrastructure has been rapidly evolving in recent times, with the continent now having the fastest-growing internet penetration rate in the world(Granguillhome Ochoa et al., 2022; GSMA, 2020). The deployment of digital technology in waste management has revolutionized the circular economy in Africa, providing an opportunity for transformational entrepreneurship in the sector. Mobile and web applications have been prominent among the digital technologies deployed in Africa towards the transition to a circular plastic economy. The use of these technologies has enhanced communication and interaction among different actors in the waste management space, leading to technical efficiency. Other digital technologies such as GIS, AI, and IoT have been deployed by a few digital innovators in Africa's plastic waste management space, providing intelligent solutions for waste management.

Economic growth in sub-Saharan Africa has been at a record pace with countries recording some of the fastest growth rates globally over the past two decades (Fuje & Yao, 2022). This growth has in turn contributed to the evolution of the digital innovation ecosystem. Other catalysts include the proliferation of smartphones on the continent and a young demographic profile, with almost 60% of the population under 25. This bourgeoning youth population is deeply connected to knowledge and is now building a significant foundation for innovation to thrive.

WeCyclers and YoWaste are examples of successful transformational entrepreneurship in the circular plastic economy. WeCyclers has implemented a gamification method through a smartphone app to connect subscribers with collectors. This approach has helped to motivate members and invigorate the ecosystem for continuous growth.

14.4.3 Challenges

Despite the significant opportunities, entrepreneurs in this space face significant challenges, including financial sustainability and regulatory barriers. For example, WeCyclers' innovative approach requires substantial funding for technology development, operations, and expansion. The slim profit margins and uncertainties in the waste management sector make attracting investors challenging. For Yo waste, based in Uganda, expanding the innovative "uber for waste" model beyond Kampala presents significant resource challenges. The company need to acquire funding to support new market entries while maintaining service quality. Below, we summarise other key challenges across the case organisations.

Inadequate Technology Infrastructure and skills

One of the challenges that emerged strongly from the results was in the area of inadequate technology infrastructure, digital knowledge, accessibility, and use. Digital technology has the potential to create value and drive growth in this sector. However, entrepreneurs need to leverage digital technology to maximize its potential. Currently most of the start-ups utilise mobile applications but are yet to integrate more sophisticated digital technology like Artificial Intelligence and Blockchains due to lack of supporting infrastructure and skills. Addressing these issues is critical for ensuring that entrepreneurs can leverage the potential of digital technology to create value and drive growth. The lack of digital knowledge and accessibility makes it difficult for entrepreneurs to leverage digital technology to its full potential. Therefore, there is a need to increase investment in technology infrastructure, digital knowledge, accessibility, and use.

Political economy

Transformational entrepreneurs in Africa's circular plastic economy face significant challenges due to weak regulatory landscapes, poor policy implementation, and enforcement. While some policies exist to promote circularity, they often lack coordination, making it difficult for niche innovations to scale, for example, Extended Producer Responsibility policies are implemented in some countries but suffer from weak enforcement, limiting their effectiveness. Additionally, some policies stifle innovation and impede digital innovations from operating profitably (Rweyendela & Kombe, 2021), for example, several of the transformational entrepreneurs complained that the lack of regulatory oversight has resulted in virgin plastics being cheaper then recycled plastics. To address these challenges, an enabling political economy is essential, and the state has a crucial role to play in implementing supportive policies and regulations. A policy framework comprised of mandatory EPR schemes, a common continental approach to standards, support policies for digital innovations, and social support policies for informal sector inclusion is recommended (Schroeder et al., 2023). Transformational Entrepreneurs must engage with the state to advocate for such policies and regulations to enable the transition to a circular plastic economy.

Sustainable Revenue Model

Entrepreneurs in the circular plastic economy often operate with slim profit margins and rely heavily on grants for funding (Oyinlola, Schröder, et al., 2022), which may not be sustainable in the long term. Therefore, increasing investment in the sector will help to support sustainable growth and development. To achieve financial sustainability, entrepreneurs need to develop sustainable revenue models that include multiple income streams based on direct returns to services and products and network externalities. Multiple income streams are critical for upscaling, sustainability, and long-term viability. The African plastics value chain needs not rely solely or heavily on grants as the source of its initial funding. As the market grows and innovations diffuse, it is expected that organizations will deploy the right entrepreneurial skills and

strategies to generate income and attract investors. Government policies and strategic public procurement will also play a key role in supporting sustainable revenue models.

Innovation and Technology

While entrepreneurs in the circular plastic economy have embraced technology, the results show that more innovation is needed across all aspects of the plastic value chain. Technologies such as AI and blockchain technology provide the potential to remove barriers to a circular plastic economy. The use of GIS, IoT, and other technologies can also enhance the productivity of these businesses (Kolade et al., 2022). Therefore, it is crucial to continue exploring and leveraging digital technology in waste management to promote sustainable economic growth in Africa. By embracing new technologies and business models, entrepreneurs in the circular plastic economy can create significant value and contribute to a more sustainable future.

Collaboration

Collaboration among stakeholders is essential for promoting the circular economy and addressing the plastic waste crisis in Africa. The results indicated that most of the players in the CPE operate in silos which often leads to duplication and inefficiencies. Collaboration can facilitate the development of shared goals, knowledge, and resources, which can lead to better outcomes for all stakeholders. The government, private sector, civil society, and other stakeholders need to collaborate to address the plastic waste crisis in Africa (Oyinlola, Kolade, et al., 2022). Collaboration can also help to address the challenges facing entrepreneurs in the circular plastic economy, such as financial sustainability and regulatory barriers.

14.4 Conclusion

The chapter has explored the critical role that transformational entrepreneurship can play in promoting the circular plastic economy in Africa. The plastic waste crisis in Africa presents a significant challenge, but it also presents a unique opportunity for entrepreneurs to create social and environmental impact while generating profits. Digital technology can enhance the productivity of entrepreneurs and help create a trusted platform for exchange across the value chain. This coupled with other drivers across the continent is leading to an increase in transformational entrepreneurship for the CPE. However, significant challenges, including financial sustainability and regulatory barriers, remain obstacles to the success of entrepreneurs in this space. Governments and investors must play a crucial role in facilitating programs that make funds available to entrepreneurs willing to venture into the circular plastic economy. They must also promote policies that address regulatory and demand advantages, creating an enabling environment for entrepreneurs.

Moreover, the inadequate technology infrastructure, digital knowledge, accessibility, and use remain significant challenges that must be addressed to promote the circular plastic economy and address the plastic waste crisis in Africa. Collaboration among stakeholders is crucial in addressing these challenges and ensuring the success of transformational entrepreneurs. The circular plastic economy in Africa is still in its early stages, but with the right policies, funding, and collaboration, transformational entrepreneurs can play a significant role in driving the transition to a sustainable future. The government and other stakeholders need to support entrepreneurs in the circular plastic economy to ensure their success and address the plastic waste crisis in Africa.

Future research can delve into the intricate balance that circular transformational entrepreneurs in the circular plastic economy must strike between social and environmental impact and the pursuit of profits. Exploring the challenges confronting entrepreneurs within this context, and proposing effective strategies to address them, could provide valuable insights for sustainable business practices. Additionally, investigating the potential roles of governments in fostering transformational entrepreneurship within the circular plastic economy, and outlining feasible implementation methods, would contribute to a comprehensive understanding of the collaborative efforts required for a successful transition to circularity.

Chapter 14 Discussion questions

- How can circular transformational entrepreneurs in the circular plastic economy balance the need for social and environmental impact with the goal of generating profits?
- What are some of the biggest challenges facing entrepreneurs in the circular plastic economy, and how can these be addressed?
- What roles can governments play to promote transformational entrepreneurship in the circular plastic economy, and how can these be implemented?
- Who are other critical stakeholders that can facilitate the growth of transformational entrepreneurship in the circular plastic economy and how can this be achieved.
- Should African governments focus on providing infrastructure for waste management rather than developing transformational entrepreneurship in the circular plastic economy?

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Appendix I
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Name	Country	Year	Summary	Digital Technology
AfricWaste (Veolia) https://www.veolia.com/africa/en/africwaste	Côte d'Ivoire	2017	AfricWaste allows users to indicate the amount of waste they would like removed and their location. The waste can then be recovered by the nearest collector, who is paid via smartphone. The project is built on the idea that waste is valuable - so AfricWaste creates a link between the people who produce it, the people who collect it and Veolia who recycles it. This relationship is facilitated by telephone payments	Mobile App
GIVO Afirca https://givosolutions.com/	Nigeria	2019	GIVO Africa provides unique and throughout B2B ICT applications to organisations in need of re-organising and streamlining their working	Mobil apps, IoT

			processes. Their speciality is to come up with tailor made solutions in specific defined processes by creating unique hardware devices that are specific for the tasks requested. The product, GIVO (Garbage In, Value Out) is an IoT, app and web-based solution which fully automates and digitizes the PET recovery process. A GIVO set consists of Hardware (scale, android, printer, shredder and solar power solution - all IoT) and software GIVO is an end-to-end recycling solution that collects and verifies recyclable material directly from households and businesses and processes them into consumer and industrial goods. Process digitization through use of IoT technology	

Chanja Datti chanjadatti.com	Nigeria	2015	Chanja Datti is a waste recycling company that rewards consumers for recycling their waste. Enrolment is done via an online portal while pickups could be done either by the portal or SMS text. Incentives include phone top-up, bill payments, shopping vouchers or cash.	
Coliba http://coliba.ci/	Côte d'Ivoire	2017	The Coliba platform is accessible to households and business customers that want their plastic waste collected. Requests for pick-up can be made via Coliba's website, mobile app or SMS platform. Users use the mobile application to schedule plastic waste pickups and are mapped to the closest waste pickers. The app is also used to report piles of rubbish, which will be geolocated and	

			collected by their pre-collectors. The Coliba app also teaches users how to properly separate waste for efficient processing	
Coliba https://coliba.com.gh	Ghana	2016	Coliba uses Web application, Mobile and SMS. Users use the mobile application to schedule plastic waste pickups and are mapped to the closest waste pickers. The app is also used to report piles of rubbish, which will be geolocated and collected by their pre-collectors. The Coliba app also teaches users how to properly separate waste for efficient processing.	
Ecofuture ecofuture.com.ng	Nigeria	2015	EcoFuture collects recyclable plastic waste at the household and business establishment level using web, Mobile App & SMS. At collection, each household's materials are	

			weighed, and this weight is then entered into a database. The households are then rewarded with redeemable points based on the volume and quality of recyclables that they donate. As points are accumulated over time, they can be redeemed for specific rewards like food items, health insurance and cash based on the quantity and type of materials they recycle with us.	
Eco-Post http://www.ecopost.co.ke	Kenya	2009	This is a point-based reward system for suppliers and a micro-franchise model for the agents and similar to that used by mobile money agents in Kenya. The agents receive the waste and measure the weight (kgs) and moisture content (%) and log the info into the app. The supplier then receives a text	

			message confirmation of the delivery and points based on the prevalent market value of the waste delivered. Clients can then redeem these points for airtime, shopping vouchers or mobile money.	
eTrash2Cash http://etrash2cash.com/	Nigeria	2016	Use web, mobile app and sms technology to exchange wastes for direct cash incentives. eTrash2Cash also makes use of all wastes collected from communities to make reusable and sustainable end products, e.g. organic compost made from food wastes for smallholder Nigerian farmers.	
Mr Green Africa https://www.mrgreenafrica.com/	Kenya	2014	Mr Green Africa is trading recyclable materials using a human-centered business model by integrating informal Waste Collectors into the value chain and leveraging technology to	

			manage and streamline operations. Mr. Green Africa incentivises marginalised waste pickers by offering premium prices and added benefits, to provide a continuous supply of valuable recyclables which in turn creates pathways out of poverty for them, while simultaneously creating a positive environmental impact. The recyclable material is then processed into valuable raw material and feeds it back into plastic manufacturers' supply chain to enable them to achieve their circular economy goals, and benefit from raw material cost savings. Through the app, consumers can sort and separate the plastic waste in their homes more effectively, before scheduling it to be collected by Mr. Green Africa from	

			their doorstep who will then process it through the plastic recycling system.	
OkwuEco https://okwueco.com/	Nigeria	2019	The app uses image recognition to educate households about recycling, and links them with merchants who can trade their waste for cash credits or mobile data transacted through the security of an online platform. Inbuilt GPS facilitates logistics connecting merchants to households.	
Packa-Ching's https://www.packaching.co.za	South Africa	2017	A Packa-Ching recycling unit consists of a recycling collection truck and trailer that services communities at designated sites on set day/s every week. Community members bring their sorted	

			recyclables, have them weighed, and in return an instant payment is made via a cashless eWallet solution to their cell phone Packa-Ching business support include: Trailer and equipment, access to cashless payment system, indication of waste hotspot collection areas, access to networks of formal collectors	
Reaval Uno Limited https://reavalworld.com/	Ghana		A technology to appropriate value to plastic waste, establish sorting centres and set up buy-back schemes which provide motivation to increase collection thereby creating empowerment and earning opportunities for members of the general and waste picker community.	
Recyclebot AI http://www.recyclebot.app/	Zambia	2018	Recyclebot has developed a digital tool - Recyclebot, which is used across the whole value chain. It provides	Mobile Apps

			a mobile app on a decentralized global network as a simple tool for any consumer to extract maximum value from their waste over the Internet. Users can use the app to sell as well asas crowdsource waste	
Recyclan https://recyclan.com/	Nigeria	2018	A mobile app and SMS service incentive people to recycle their waste.	
Recycle points recyclepoints.com	Nigeria	2012	This model is an incentive “Point-Based” collection program that allocates “Points” to the quantity of recyclable items neatly collected at the point of disposal by post-consumers who in turn use the earned “Points” to redeem numerous identified household items and services. Subscribers to the scheme are given Green Cards, on which items collected and counted are recorded against	

			each week of the month. Recyclers get an SMS notification at the end of the week on the number of “Points” gained, and the “Points” gained could be traded in exchange for equivalent tagged items available at the RecyclePoints “iRecycle Store”. Redeemed items are collected from RecyclePoints office or delivered to the Recycler directly on request. Bonuses are awarded for any environmentally friendly activity. Potential Recyclers register to join the iRecycle Network and earn points from various identified recycling activities.	
Rent-A-drum	Namibia	1989	Collectors use mobile phones to contact Rent-A-Drum company for collection of waste and are awarded incentives for waste collected through a digital	

			payment system (E-wallet)	
Scrapays https://scrapays.com/	Nigeria	2019	The startup uses USSD, mobile app, web app and Internet of Things (IoT) tech to facilitate the decentralised recovery of recyclable waste. Waste producers, individuals or enterprises, are able to optimise their recyclable disposal process by having localised collectors remove such waste, saving them time and helping them earn money from recycling.	
Takacycle http://www.takacycle.com/	Tanzania	2019	Easy waste collection infrastructure for recycling to help, teach and incentivize people to capture value from their waste. A smart waste collection platform and rewards for recycling. Mobile application for waste collection in	

			Tanzania neighbourhoods	
Techbionics Ventures	Nigeria	2018	Techbionics Ventures is an innovative hardware healthcare start-up. The solution is to use cutting edge technologies (3D printing, 3D scanning, and laser cutting) to recycle hazardous waste plastics in the environment into affordable (as low as $50) and customized prostheses for people living with a form of disability or the other.	
Ulubuto	Zambia	2019	Ulubuto is a company providing a technology solution to sensitize the populace in Zambia on the negative effects of not taking care of one's environment, including informing them on how everyday trash can be a source of income. A mobile application which will be made free	

			for the public to download will have features that would help individuals find available aggregators of recyclables to pick up their recyclables upon request.	
Vicfold recyclers http://www.vicfoldrecyclers.com	Nigeria	2016	VICFOLD Recyclers is a web based service that allows consumers to schedule Recycleable Waste Pickup by Phone Call / SMS request. A Waste Interceptor visits collectors for collection and reward subscribers with earn Green Points. Waste collectors do registration of intending subscriber online.	
Virdismart virdismartco.ke/	Kenya	2019	Automation of waste collection and management services. It features a Smart Bin that gives rewards for its users after swiping their ID tag. Rewards are received once the company gets the	

			packaging material.	
Waste Recycling App (Wrapp) https://wrapp.co.za	South Africa	2008	WRAPP is a waste management and advisory business that allows clients to arrange waste removal and recycling. The app, allows customers to select the type of waste, type of truck and time of collection for loads from 1.3 to 12 tonnes Payment takes place after the waste has been delivered and can be done through a credit card or by EFT – both using the app	
Wastezon https://wastezon.com/	Rwanda	2018	Wastezon app is a platform that connects households/individuals seeking to sell their solid wastes with recycling companies	
WeCyclers http://www.wecyclers.com/	Nigeria	2012	The Wecyclers app is used by the collectors to store the number of recyclables collected from each location and	

			their respective addresses.	
Yo-Waste https://yowasteapp.com/	Uganda	2018	Yo-Waste is a tech waste management company that provides waste, recycling, and smart city solutions to businesses and governments. It connects local waste haulers and recycling businesses to customers who need their services using the Yo-Waste mobile app and website. Allowing households and businesses to get on-demand waste collection services while keeping data.	