# Enabling Circular Economy in African Economies: Identifying Skills for Circular Business Models in Start-Ups

# Enabling Circular Economies in African Economies: Identifying Skills for Circular Business Models in Start-Ups

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# Abstract

The Circular Economy (CE) offers a sustainable approach to resource management, but its implementation in African economies faces challenges. This study explores the skills required by circular start-ups (CSUs) in Africa to operate Circular Business Models (CBMs). While existing literature identifies the importance of skills in CE, there is a gap in empirical studies focusing on skill development for CBMs in Africa. Using an abductive research approach, this study employed qualitative methods through interviews with 30 CSUs across nine African countries. The research develops a skill taxonomy specific to CSUs operating across African economies by identifying needed skills and understanding external factors influencing them. Findings show that all skills from the baseline taxonomy are essential, with added emphasis on circular literacy and adaptability. Skills like material analysis and value chain collaboration, traditionally seen as general, are reclassified as circular skills crucial for CSUs. Significant skill gaps are noted due to educational misalignment, economic factors, and the novelty of CE in Africa. CSUs address these gaps through in-house training, educational collaborations and role flexibility. This research highlights the importance of internal capabilities and adaptability in CSUs, offering practical insights for entrepreneurs, policymakers, and scholars to support the growth of CSUs in Africa. Further research is encouraged to advance CE practices in diverse contexts.

# Preface

I hereby present my master's thesis titled "*Enabling Circular Economy in African Economies: Identifying Skills for Circular Business Models in Start-Ups*". To meet the graduation requirements for the Master's program in Innovation Sciences at Utrecht University, this thesis was developed. I worked on writing the research proposal and thesis from September 2023 to June 2024.

My journey has not only sparked my interest in how novel technologies can be applied in different contexts, but also sparked a deep fascination with the transformative potential of business models in the global economic landscape. This fascination is what led me to discover the concept of circular economies—an important area of innovation that holds significant promise for sustainability and economic development in the Global South.

I want to extend my gratitude to my supervisor, Lucas Straub, for his guidance throughout this process. The insights and feedback he provided have been important in shaping this research. The collaboration and conversations we shared have supported my learning experience and pushed me to refine my ideas.

Finally, I'd like to make a special thanks to all the founders I had the privilege of interviewing during my research. Their willingness to share their insights and experiences was important to the depth and scope of this thesis. These discussions not only enriched my understanding but also highlighted the passionate commitment of these leaders to driving positive change through their circular business models.

Without their perspectives, this thesis would not have been possible. Their stories and drive have deeply inspired me and I hope that this thesis serves as a prompt to encourage other researchers to further explore and support the development of circular economies in Africa.

Quinty van Niel
*Utrecht, June 06, 2024*

# List of Abbreviations

| | |
|---|---|
| CE | = Circular Economy |
| CBM | = Circular Business Model |
| CSU | = Circular Start-up |
| GS | = Global South |
| GN | = Global North |
| ILO | = International Labour Organisation |
| RQ | = Research Question |

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# 1. Introduction

The concept of Circular Economy (CE) has gained attention worldwide for achieving sustainable resource management and reducing environmental impact (Ghiselini et al., 2016). While CE practices have been adopted in Europe, North America, and East Asia (Preston & Lehne, 2017), their implementation in the Global South (GS) faces challenges. Despite these challenges, adopting a CE strategy can enable emerging economies to leapfrog towards sustainable development by learning from and avoiding the resource-intensive pitfalls of the linear economy (Preston and Lehne, 2017). However, these regions often deal with informal economies, diverse cultural norms and infrastructural deficits, distinguishing their CE application from that in the Global North (GN) (ILO, 2023). Although some CE practices and initiatives are identified at various levels of African society (Erku et al., 2023), they remain largely hidden (Desmond & Asamba, 2019). Both government and private sector efforts play significant roles in accelerating the adoption of CE and closing the circularity gap (Henry et al., 2020; Han et al., 2023). The government can drive progress through policy and regulation, while the private sector can innovate and implement practical solutions. The latter requires the design and implementation of business models that minimise resource use and maximise value extraction throughout the process (Geissdoerfer et al., 2020). These circular operations on a micro-level, which aim at closing the loop and making the 'end-of-life' concept obsolete, are defined as circular business models (CBMs, further specified in the following chapter) (Henry et al., 2020). However, the skills required for implementing CBMs in have been overlooked (Straub et al., 2023) and acquiring necessary skills for CBM initiatives is difficult due to the need for educational institutions and employers to align training programs with the demands of CE (ILO, 2023). While the CE offers potential for sustainable development and socio-economic growth in the GS (Preston & Lehne, 2017), the development of necessary skills for CBMs remain a challenge that need to be addressed to maximise their impact (Velis, 2017).

Despite a growing body of grey literature emphasising the role of skills in facilitating the CE and its transition (Büyükyazıcı & Quatraro, 2024), there is limited availability of empirical studies on skill development for CBMs. Existing studies mainly focus on a part of circular activities (De los Rios and Charnley, 2017), skill differences across circular and non-circular employment (Burger et al.,2019) and lastly, Straub et al. (2023) being the first to develop a comprehensive skill taxonomy for CBM implementation. Moreover, most studies on skills are centred on the GN (van Teeffelen, 2020), resulting in a gap in literature that hinders the implementation of CBMs in other regions within the GS, as the skills required for these models often differ from those currently possessed by businesses (ILO, 2023). This issue is particularly pronounced in African contexts (Mhlanga et al., 2022). The reason for directing research towards Circular Start-Ups (CSUs, further specified in the following chapter) in African context lies in their higher adaptability to disruptive CBMs and the potential to significantly contribute to the transition toward a CE due to a limited organisational dependency, higher flexibility and responsivity than incumbents (Henry et al., 2020). The focus on

CSUs pursuing a CBM is critical, given the potential for CSUs to significantly contribute to the transition toward a CE, in comparison with incumbents. Additionally, the focus on CSUs is an opportunity for private-sector led development which can close the circularity gap (Han et al., 2023).

The aim of this research is to identify and analyse the relevant skills required for implementing CBMs in CSUs within the African economy. The study seeks to validate and expand upon the baseline skill taxonomy proposed by Straub et al. (2023) by leveraging insights from CSUs operating in Africa, thereby addressing the unique contextual challenges and opportunities in this region. The evaluation of the skills outlined in Straub et al.'s (2023) taxonomy serves as the foundation for this study's methodology and will now be referred to as the baseline taxonomy. Therefore, this research will be guided with the following formulated research question (RQ):

***How do circular start-ups in African economies develop and apply the needed skills to operate Circular Business Models?***

This is broken down in the following sub-research questions (sub-RQ):

*Sub-RQ 1: What are needed skills to operate a Circular Business Model?*

*Sub-RQ 2: Which skills are particularly relevant and why?*

*Sub-RQ 3: What strategies do circular start-ups use to develop and bridge gaps in the needed skills for operating a Circular Business Model?*

The sub-RQs were operationalised through interview questions that aimed to identify needed skills skills for CBMs, understand the particular relevance of these skills by linking them to ecosystem factors and investigate strategies for bridging skill gaps in African CSUs.

This study fills a gap in the literature by providing empirical data on the skills required for CBMs in African CSUs. This study validates and expands the skill taxonomy proposed by Straub et al. (2023) within the unique context of Africa. It identified additional skills necessary for CBMs that are specific to African CSUs, improving the theoretical understanding of skill requirements in diverse socio-economic environments. Additionally, the research provides empirical data on the specific skills required for CBMs in African contexts, something that has been lacking in previous studies which are predominantly centred on the GN (van Teeffelen, 2020). The study's findings offer recommendations for re-skilling and skill mapping to support the growth and sustainability of CSUs.

Additionally, this research provides data on the specific skills required for CBMs in African contexts, addressing a gap left by previous studies focused on GN (van Teeffelen, 2020). The findings offer recommendations for re-skilling and skill mapping, informing policy development and educational programs tailored to the CE in Africa. These insights align with the United Nations' Sustainable Development Goals (SDGs), including Decent Work and Economic Growth (SDG 8) by promoting job creation and sustainable practices, Industry, Innovation, and Infrastructure (SDG 9) by supporting sustainable industrialization, and Responsible Consumption and Production (SDG 12) by advocating for sustainable consumption and production patterns.

The structure of this research is organised into the following sections: Section 2 consists of a literature review on CBMs for CE, the integration of skills for a CBM and skills in the GS; Section 3 details the research methodology, including design, data collection, operationalisation of concepts and analysis techniques; while Section 4 focuses on the results and closed off with Section 5 as a discussion and a conclusion in Section 6.

# 2. Theoretical Framing

This chapter starts with a general introduction to the CE, followed by an overview of CBMs and their role in the transition towards a CE. Subsequently, the chapter classifies the skill types necessary for implementing CBMs and concludes with a section exploring skills relevant in the context of the GS.

## 2.1. CBMs for a CE

The traditional linear production model has dominated economies and lead to production technologies and job structures focused on resource extraction, consumption and waste (Tura et al., 2023). Moving towards a CE requires new policies and business strategies to accelerate this transition (Büyükyazıcı & Quatraro, 2024), as the linear model is considered unsustainable due to its resource consumption (Geissdoerfer et al., 2017). To facilitate this shift, businesses must adopt business models that emphasise resource efficiency and waste minimisation. CBMs offer such an approach by integrating the principles of CE into their operations (Lüdeke-Freund et al., 2018). Recently, more studies have started exploring CBMs as a sustainable pathway towards achieving CE (Lüdeke-Freund et al., 2018). The idea of CBMs is rooted in the research domain of business models (Magretta, 2014; Wirtz et al., 2016; Casadesus-Masanell & Ricart, 2007). CBMs involve conducting business operations that integrate principles of CE, employing strategies to reduce, limit, or close resource loops (Geissdoerfer, 2018; Nußholz et al., 2019a; 2019b) and are enablers to a CE (Henry et al., 2020). Additionally, Mehrotra & Jaladi (2022) find that transitioning towards circularity in emerging economies can be accelerated when start-up ventures adopt CBMs. However, research on CBM implementation focuses on incumbent and often overlooks new, independent and active companies pursuing a CBM -further defined as CSUs- (Henry et al., 2020; Henry & Kirchherr, 2020).

## 2.2. Business Models for CSUs

A CSU is characterised as a business that applies a business model that aims to pursues at least one CE strategy (Bauwens et al., 2019). CE strategies are: Reduce, Reuse, Recycle, Recover and Regenerate, referred to as the 4R framework (Kirchherr et al., 2017). Henry et al. (2020) define five primary CSU archetypes based on the nature of their business models and circular strategies: design-based, waste-based, platform-based, service-based, and nature-based start-ups. This classification of CSUs into different archetypes facilitates an understanding of the skills needed by each type and whether certain skills are related to specific archetypes, to which to the knowledge of the author is not yet studied. Each archetype embodies aspects of CE principles (Henry et al., 2020).

### *2.2.1. Design-based Start-ups*

Design-based CSUs focus on minimising resource use from the beginning of the product life cycle and combine the ‘Reduce’ strategy within the 4R-framework (Henry et al., 2020). These start-ups engage in activities such as source material minimisation, product design optimisation and production process efficiency. Skills in lifecycle analysis to evaluate the environmental impact of products from design to disposal are crucial (Henry et al., 2020). Efficient project management is crucial for this business model archetype, as the execution of new strategies necessitates handling change, which is a skill found among its start-up employees and needed for sustainable practices (Ismayilova & Silvius, 2020). Continuous improvement in quality control is necessary due to the novelty of CBM as a concept, requiring ongoing evaluation and adaptation (Velenturf & Purnell, 2021). Due to it being a challenge for firms to create awareness among customers and include them in their circular practices (Kirchherr et al., 2017; Young et al., 2017), design-based start-ups are ensured that their products are not only sustainable but also appealing to customers.

### *2.2.2. Waste-based Start-ups*

Waste-based CSUs extract value from waste streams, turning what would be discarded into valuable inputs for new products or energy and thus focus on the lower R-strategies (Henry et al., 2020). Understanding regulatory frameworks and developing efficient recycling technologies are found to be critical for this archetype (Baldassarre et al., 2019’ Chertow, 2000), also because the actors in the ecosystem don’t have legislative clarity about waste-streams (Henry et al., 2020). What is also found for this archetype is the ability to manage projects involving multiple stakeholders and continuous improvement processes are essential due to the complexity and novelty of the CBM (Köhler et al., 2022; Sanchez & Haas, 2018). Waste-based CSUs can benefit from skills in value chain collaboration to develop and maintain partnerships that facilitate recycling and reusing waste materials (Kanda et al, 2021; Geissdoerfer et al., 2017). Additionally research by Agyabeng-Mensah et al. (2022) found that while implementing internal green supply chain practices alone may negatively impact firm performance, incorporating supply chain environmental cooperation and human resource management can improve the performance of a firm.

### *2.2.3. Platform-based Start-ups*

Platform-based CSUs operate digital or physical platforms that facilitate the sharing, trading, or leasing of goods and services, thus reducing the need for new products (Henry et al., 2020). Skills in information technology, software development and system design are critical to building and maintaining these platforms (Ritter & Schanz, 2019; Van Dijck et al., 2018). Other studies suggest that the sustainable purpose and project management are vital for platform-based start-ups, as they must manage complex digital platforms that require continuous improvement and innovation

(Prieto-Sandoval et al., 2018). Due to the digital nature of the platforms, skills in data analytics are necessary to optimise its operations and enhance user experience, making these start-ups highly dependent on digital capabilities (Awan et al., 2021b; Kristoffersen et al., 2021).

#### *2.2.4. Service-based Start-ups*

Service-based CSUs offer product-as-a-service models where the focus shifts from selling products to leasing or sharing them, focusing on the R-strategy 'Reduce'. Service-based CSUs offer product-as-a-service models where the focus shifts from selling products to leasing or sharing them. These start-ups need skills in service design, customer engagement, and logistics management. Creating and managing efficient reverse logistics networks is essential to their success (Tukker, 2015; Wastling et al., 2018). Operational business skills, including business and product management, are found to be essential for service-based CSUs. Operations management, negotiation, forecasting and international business skills, as outlined by Lopes de Sousa Jabbour et al. (2019), are integral to operational management tasks. Additionally, proficiency in legal and governance skills is crucial for navigating intellectual property and regulatory issues, as emphasised by Khan et al. (2020).

#### *2.2.5. Nature-based Start-ups*

Nature-based CSUs leverage natural processes to offer products and services that are inherently sustainable. These start-ups require skills in environmental science, ecological engineering, and sustainable agriculture. Understanding natural ecosystems and how to integrate them into urban environments is crucial (Maes & Jacobs, 2017; Campanhola & Pandey, 2019). Studies highlight those systems skills, including systems thinking and value chain collaboration, are essential for nature-based start-ups. These skills involve understanding the broader socio-economic and socio-technical systems and developing partnerships that facilitate circular ventures (Blomsma & Brennan, 2018; Kristoffersen et al., 2021). Ecosystem building is therefore crucial, as these start-ups need to develop networks beyond direct business interactions (Agyabeng-Mensah et al., 2022).

## 2.3. Integration of Skills for CBMs

The overarching concept in which this study is grounded is capabilities, specifically concentrating on a sub-area that explores skills. There are roughly two dominant streams in literature, being operational and dynamic capabilities (Drnevich & Kriauciunas, 2011). While ordinary capabilities support daily operations, dynamic capabilities empower organisations to transform aspects like products, processes, or customer markets (Winter, 2003). Microfoundations serve as basis that

management must cultivate to improve those capabilities (Ambrosini & Bowman, 2009) and involve interactions among these components (Abell et al., 2008; Felin et al., 2015). They include individuals and their skills, processes, technology and organisational structure (Felin et al., 2012), the visualisation of the connection between microfoundations and organisational capabilities are presented in Figure 1. Expanding on the reasoning presented of Straub et al. (2023), this research explores skills that are collectively held within a business, viewing organisation's capabilities as clusters of microfoundations rather than sums of individual skills held by specific individuals.

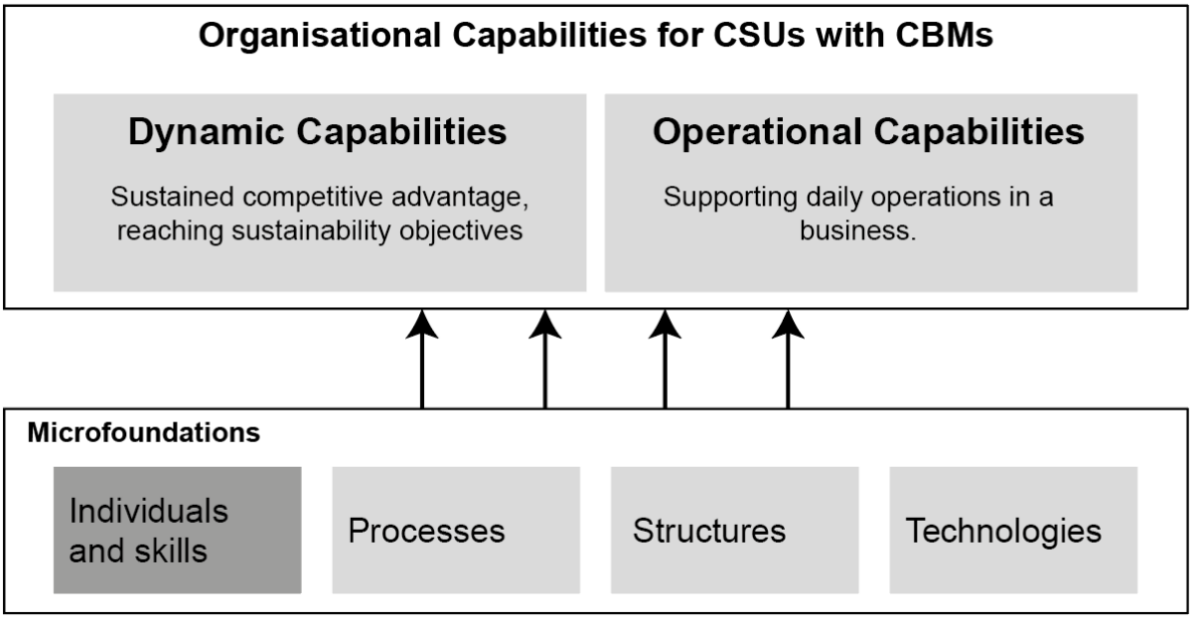


*Figure 1, Conceptual model of organisational capabilities and skills for a CBM (Source: Straub et al. (2023))*

A skill is in this research defined as "*the ability to perform a task*" referring to a specific activity (Rodrigues et al., 2021). The combined skills of individuals within an organisation, referred to as the organisation's collective skills, are a vital asset (Zeca, 2019). The relatedness between R-strategies which are discussed in 2.1 and skills can be linked closely: Findings of Büyükyazıcı & Quatraro (2024) indicate that implementing circular strategies to reduce material usage increases the demand for transport and logistics skills. Additionally, they argue that digitalisation boosts the necessity for R&D and IT skills, while waste recovery calls for technical skills. Similar to this is a study by Vona et al (2015), who find that key 'green' skills, which have a strong analytical and technical content particularly in Science and Engineering disciplines, are crucial for transitioning to green occupations. Their study highlights that environmental regulation increases the demand for scientists and engineers, for which it can be assumed that education is a critical component in promoting sustainable economic growth. Straub et al. (2023) states that skills and capabilities for CBMs are frequently categorised as general, sustainable, or circular and highlight the need for a combination of these skills to implement CBMs in CSU environments.

### 2.3.1. General skills

General skills refer to the ability to perform tasks effectively, often acquired through experience or on-the-job training (Burger et al., 2019). General skills are needed in various occupations, supporting fundamental business functions and operational efficiency (Christenko et al., 2019). For example, teamwork, effective communication, problem-solving and critical thinking, are referred to as key skills for the operation of any business (Goltz et al., 2007). Burger et al. (2019) argue that while these skills are universal across various sectors, their importance in the CE is heightened due to the innovative and often complex nature of circular business processes. In CSUs, these skills underpin the daily operations and are crucial for navigating the challenges associated with sustainable business practices. Straub et al. (2023) classifies 32 general skills across six skill categories and defines them as skills used in a linear business, as for example ‘research’. A sorted list can be found in Appendix F

### 2.3.2. Sustainable Skills

Sustainable skills extend beyond general business competencies to include specific abilities that support the three pillars of sustainability: environmental, social, and economic (Straub et al., 2023). These skills enable individuals to make decisions and take actions that contribute to the longevity and sustainability of the business while minimising environmental impact and enhancing social goodwill. Sustainable skills are significant in the context of CSUs, where the alignment of business operations with broader environmental and social goals is critical (Burger et al., 2019). These skills facilitate the integration of sustainable practices into core business strategies and support the company’s ability to operate effectively within the CE. In the baseline taxonomy, Straub et al. (2023) classified 6 sustainable skills.

### 2.3.3. Circular Skills

Finally, circular skills focus on practices that “cycle, extend, intensify, and/or dematerialise material and energy loops” within an organisation, minimising resource use and waste (Geissdoerfer et al., 2020). Circular skills are specialised competencies that specifically address the practices of reducing waste and enhancing resource efficiency, which are central to the circular economy. These skills involve the ability to redesign systems and processes to close the loop of resource use, extending the life cycle of products, and minimising waste. Burger et al. (2019) highlight the critical role of circular skills in enabling businesses to implement and optimise circular business models effectively. Skills related to resource management, waste reduction and lifecycle assessment are particularly relevant, allowing firms to innovate and maintain competitiveness in a CE.

The integration of general, sustainable and circular skills forms a taxonomy that supports the operational and strategic needs of CSUs. Burger et al. (2019) suggest that while each category of skills contributes uniquely to the business’ success, the interaction among these skills can improve

the firm's capacity to implement CBMs. For example, problem-solving skills (a general skill) are crucial when addressing the technical challenges of waste reduction (a circular skill), while sustainable skills ensure that these solutions align with broader environmental and social objectives.

The baseline taxonomy for CBM implementation by Straub et al. (2023) as shown in Figure 2, identifies 40 skills distributed among six categories: business innovation, operational, social, systems, digital and technical skills. A skill taxonomy can be defined as a "structured list of skills defined at the organisational level, aiming to identify the capabilities of a business in a quantifiable way." (AIHR, 2023), which allows for identifying skills gaps between individuals and jobs and allows employers and entrepreneurs to take a skills-based approach instead of a role-centred one (Lutkevich, 2023). The baseline taxonomy is the first large-N effort which clusters skills across six categories, with 32 general, 6 sustainable and 2 circular skills identified, which are discussed in the previous sections. Implementing a CBM thus requires a combination of such skillsets, but it is unknown whether these skills are required in practice. Academic literature on the skill requirements for the CE, in terms of occupations and industries, can be categorised into two main approaches: small sample surveys or interview-based case studies and analyses utilising large-scale workplace skills data (Büyükyazıcı & Quatraro, 2024). This research falls under the first category, where rich data will be collected.

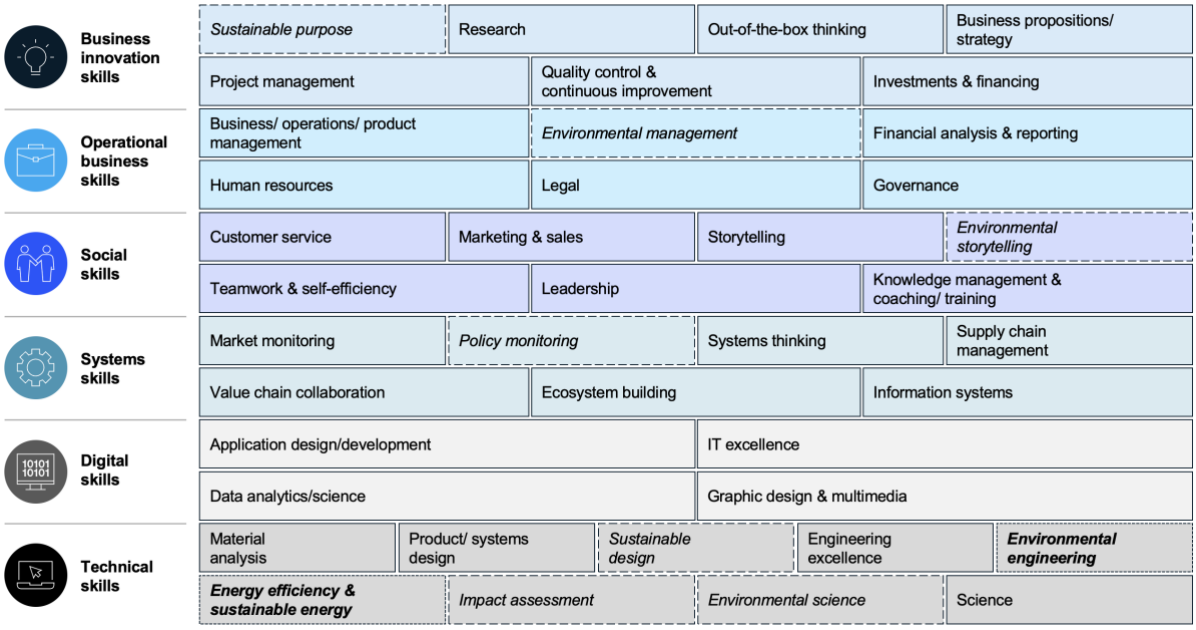


*Figure 2, Skills taxonomy for CBM implementation as proposed by Straub et al. (2023). Sustainability/environmental skills are italicised with a long-dash outline; circular skills are italicised and bolded with a short-dash outline; all other skills are general. (Source: Straub et al. (2023))*

## 2.4. The linkage Between CE and Skills in the GS

While the CE offers potential for sustainable development and socio-economic growth in the GS (Preston & Lehne, 2017), the development of necessary skills for CBMs remain challenges that need to be addressed to maximise their impact (Velis, 2017).

### *2.4.1. CE-Approaches in the GS*

GS environments, characterised by limited resources, underdeveloped technology and a lack of institutional support, act as a barrier for entrepreneurs that seek resources to translate an innovation to a business model (Bruton et al., 2013). The dominant perspectives of CE rely heavily on corporations staying as they are and continuing to use fragmented production technologies. (Schroeder et al., 2018). Yet, both assumptions are increasingly being scrutinised and questioned. Glutting and Shankar (2022) underline the discourses for a CE that are framed by northern ideas of sustainability, where they fail to include the GS economic conditions with resource intensiveness, import of waste from GN, informality and export-oriented economies. It is therefore required to have a tailored approach to skill development (Manning & Vavilov, 2023). ILO (2023) highlights a geographical difference in the required skills for CE between regions and suggests that skills required for CBM, may not align with what research finds in practice, showcasing a difference between theoretical and real-world skill requirements for CBMs in different geographical areas. More specifically, countries like India, China, and South America demonstrate small-scale CE practices such as waste collection, recycling, and using biomass as fertiliser in agriculture (Gower & Schroder, 2016). Despite a slight decline in informal activities over the past decade, Africa continues to have the largest informal sector globally (Medina & Schneider, 2019; Ulyssea, 2020), with different levels of CE practices across the continent. The informal economy is defined as economic activities that are not regulated by the government and typically operate outside the formal sector, often characterised by a lack of formal recognition, regulation, and protection (Chen, 2012). While some nations are only beginning to integrate certain CE aspects, others, like Ethiopia, Kenya, and Rwanda, have established overarching strategies (Desmond & Asamba, 2019). In Africa, the focus is often on job creation, income generation, and maximising resource use (Desmond & Asamba, 2019). Despite the presence of circular activities, African case studies often remain 'hidden' and undocumented in academic research, limiting their visibility and impact (Desmond & Asamba, 2019).

### *2.4.2. Skills for CSUs in Africa*

CE strategies can reduce dependency on imported raw materials, create green jobs, and promote environmental sustainability (Preston & Lehne, 2017; Ghisellini et al., 2016; ILO, 2023). The growth of CSUs in Africa demonstrates the potential to bypass traditional, resource-intensive development models and drive CE transitions, although these start-ups have been largely overlooked (Santa-Maria et al., 2022; Henry et al., 2020). There are a few exceptions, Tibaingana et al. (2023)

underscore the significance of management, technical and personal maturity skills for sustainable business start-ups among youths in Uganda. It highlights the role of a well-rounded skill set in fostering sustainable enterprises. Moreover, Mamabolo et al. (2017) examined the skills African entrepreneurs required to operate their businesses effectively and identified key areas as for instance financial management, human resource management, social and interpersonal skills, leadership, personality traits, marketing, technical abilities, and business management. Though the general skills identified by Mamabolo et al. (2017) are foundational, there is limited research focusing on the *specific* skills needed for CSUs in Africa. Whereas Straub et al. (2023) are the first to study skills and capabilities for start-ups with a CBM, to the author's awareness, no study has investigated relevant skills within CSUs in African economies.

# 3. Methodology

## 3.1. Research Design and Description

This study adopts an abductive research approach and will utilize the existing taxonomy by Straub et al. (2023) as a framework for conducting interviews. Abductive reasoning begins with the observation of certain events to construct explanations for them through iterative interaction with theory and data (Bell et al., 2018). The deductive component enables structured data analysis against literature, however, the study will also be responsive to emerging patterns and themes from the data, given that this study validates the baseline taxonomy but also extends it by incorporating identified skills and contextual nuance. The inductive aspect allows for generating new theoretical perspectives relevant to the specific ecosystem of the GS. The abductive approach connects the testing of theories with the discovery of context-specific knowledge, ensuring the research is grounded in the theory as described in the previous chapter.

A qualitative research design was followed, which allows to provide insights that are essential for an understanding of phenomena adapted to localised conditions (Eisenhardt, 1989). This design is relevant to this study as it facilitates an understanding of the needed skills within Africa. Real-life case studies are instrumental in gaining such in-depth insights, as they offer concrete examples of complex dynamics in practice (Sumter, 2020). To further investigate and elaborate on the skills within the baseline taxonomy, this study will gather empirical evidence through interviews with founders or specialists within the business. These interviews aimed to validate the existing skills taxonomy but also refine and adapt it and to reflect the skill needs and gaps of CSUs operating within its environment. Figure 3 presents a summary of the method.

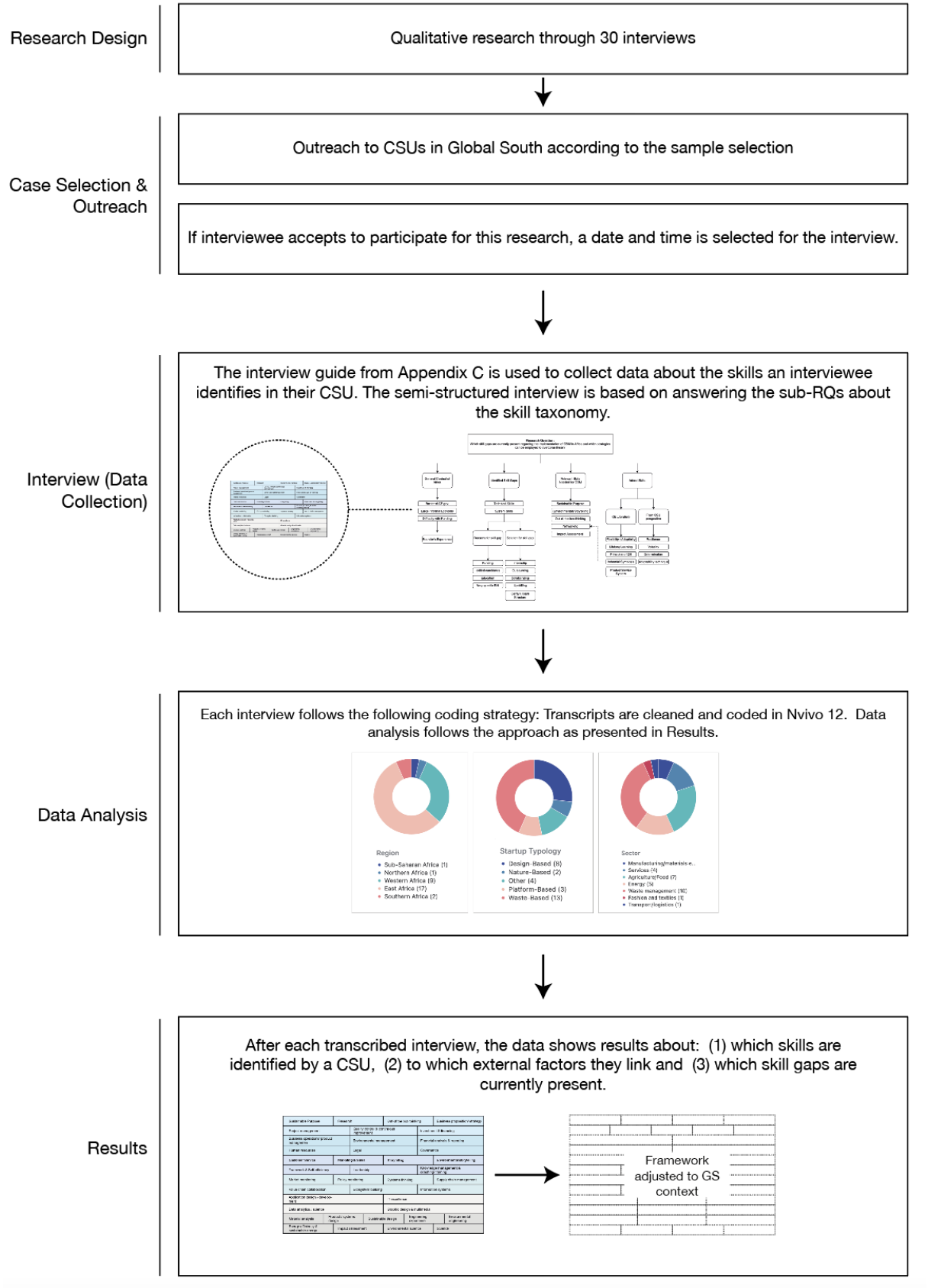


*Figure 3, Overview of method (Source: Author)*

## 3.2. Case Selection

CSUs were found through different sources. First, a list of CSUs was leveraged from a database that collects information of GS based start-ups that pursue a CBM. This database was developed by researchers at the Sustainability Management at the University of Wuppertal and not openly accessible. Besides this, relevant cases were found through the Circular Start-up Index which is owned by the Ellen McArthur Foundation. The specific criteria for the CSUs are shown in Table 1 below. Once a CSU met the criteria, the outreach strategy in Table 2 was followed, which started with an E-mail in (Appendix B). Start-ups were approached for first contact with an E-Mail that can be found in Appendix A. After filtering, a total of 73 remained from which 30 participants agreed upon the interview which is 41.1% of the total sample.

| Criteria for sample selection | Explanation |
|---|---|
| **Applying a CBM** | The business model must pursue at least one CE strategy as specified by Bauwens et al., (2019). |
| **Operating in Africa** | The CSU requires to operate in a country which is classified as low or lower-middle, according to World Bank. |
| **Language Criteria** | The interviewee requires to understand the English language. |
| **Interviewee** | C-level, specialist within the business. |

*Table 1, Overview of criteria for sample selection (Source: Author)*

When a sample is selected the following outreach strategy is employed:

| Phase | Activity |
|---|---|
| **First contact** | An outreach email as found in appendix B is sent. |
| **Second contact** | If respondent does not respond in 5 business days, a reactivation email is sent. See appendix C |
| **Third Contact** | Along with the contact details that were available, the CSU was approached through Facebook in a message by the researcher |
| **Fourth Contact** | When founders listed a telephone number, the CSU was approached through WhatsApp. |

*Table 2, Outreach strategy for interviews (Source: Author)*

## 3.3. Presentation of the Sample and Scope

A total of 30 interviews between January 2024 and May 2024 were conducted with founders or C-level specialists in a total of 9 different countries in Africa, the table can be found in Appendix E. This number of respondents aligns with Morse (1994), who states that 30-50 interviews is sufficient for qualitative research. The decision to include a higher number of CSUs, and thus a higher number of empirical data points, increases the validity of the analysis of the baseline taxonomy. A purposive sampling approach was used to ensure quality of the sample. This research adopted the geographical scope of Kirchherr & van Santen (2019), who operationalise this difference based on the World Bank's classification by income: low, lower-middle, upper-middle, and high-income countries. Low and lower-middle developing countries within Africa were included in this sample.

Summarised, from the total sample 13 of the 30 CSUs were identified by the author as a waste-based archetype as by the framework of Henry et al. (2020). Followed by 8 Design-based CSUs and 4 Other-based CSUs. There were 2 businesses that followed a Nature-based start-up typology and 3 CSUs were identified as platform-based.

## 3.4. Operationalisation of Answering Sub-RQs

This section outlines how the sub-RQs were answered through the interview. It served as an approach to measure relevance, their correlation with capabilities within the context of CSU operations and relevance of the skill. Table 3 showcases how each sub-RQ was addressed during the interview. During the interview, the taxonomy was presented through screen sharing and the researcher asked questions from the interview guide to explore whether skills are present, relevant or missing. The interview started by asking about the prior experience of the founder. It is found by van Weele et al. (2017) that entrepreneurs are unconsciously incompetent and sometimes unable to identify resources. However, Stuart & Abetti (1990) found in their research that entrepreneurial experience is one of the most important factor related to success and provides knowledge on identifying important tasks, how to do things and a network. The interviewee is therefore asked about their experience to tackle this limitation. Wasdani & Mathew (2014) categorise entrepreneurs operating beyond 3 years as late-stage entrepreneurs. This category of entrepreneurs possesses the capability of recognising opportunities and demonstrate skills in exploiting them for commercial success.

| | Semi-Structured Interview question(s) to which the Sub-RQ is linked to | How Sub-RQ and interview question(s) link together |
|---|---|---|
| **Introduction** | 1) Could you please tell more about your role in the firm and your prior experience? | At the start of the interviews, founders were asked about their experience with entrepreneurship as this can influence the ability to recognise and identify skills in their business. |
| | 2) What does your business do? | These questions were used to learn about the interviewee's business model based on the typology of Henry et al. (2020), which provided background information and to compare whether different business models have different importance in skills. |
| **(Sub-RQ1) What are needed skills to operate a Circular Business Model?** | 3) Which of the skills from the taxonomy can you confirm as needed/relevant for your business? | Sub-RQ1 aims to identify the specific skills that are necessary to effectively operate a circular business model. Question 3 directly addresses sub-RQ1 by asking participants to confirm which skills from the baseline taxonomy are relevant for operating their CBM, thus identifying the needed skills. |
| **(Sub-RQ2) How do skills interact with ecosystem factors to influence the required skill sets?** | 4) What is the top 5 that your organisation currently needs for running your business model | Sub-RQ2 aims to understand the interaction between specific skills and ecosystem factors and how these interactions shape the skill sets required by circular start-ups. Identifies the top 5 critical skills and linked them to specific activities and provides examples of how these skills are applied in practice. |
| | 5) For the skills you mentioned earlier, could you provide explanations of why they are applied in specific job activities or functionalities within your organisation? | Supports in highlighting which skills are deemed essential by the CSU and why, revealing the ecosystem factors influencing these skill requirements. Provides concrete examples of how these skills are utilised in the business, illustrating the direct interaction between the skills and ecosystem factors in practical terms. |

| | | | |
|---|---|---|---|
| **(Sub-RQ3) What strategies are employed to bridge identified skill gaps effectively?** | 6) | Do you currently possess all of these skills? | Identifies skill gaps and explores challenges in acquiring necessary skills, aiding in comparison with skill availability in the GN. |
| | 7) | What are some of the challenges you face in finding the right skills for your organisation? Why do you not have these skills? | |
| | 8) | How do you address the skills that are missing? | This question is linked to identifying strategies that CSUs apply to close skill gaps. |

*Table 3, Operationalisation of sub-RQs (Source: Author)*

## 3.5. Interview Guide and Implementation

Tailored to address the sub-questions and building on the framework of Straub et al. (2023), the interview guide features 8 questions, spread across themes with one to two questions each -see Table 3 above-. This structure was intended to identify and verify the skills and assess them on relevance, avoiding binary responses and obtaining deep insights (Bryman, 2015). The interviews took between 60-90 minutes which allowed to collect rich data (DiCicco-Bloom & Crabtree, 2006) and follows the structure which is shown in Appendix C. Participants were asked to rank the five most important skills, rather than scoring them, to facilitate understanding of trade-offs and priorities among the skills. This approach provided more informative and nuanced data on the importance and relative value of different skills in start-up environments. A day before the interview, the interviewee was sent a consent form, which is found in Appendix D.

## 3.6. Analysis Method and Measurements of Concepts

After an interview was completed, the transcript of an interview was analysed to translate the raw data to coding categories in Nvivo 12. The interviews were voice-recorded, which allows the researcher to re-listen if required and transcribe the interview by hand or with appropriate software such as Microsoft Azure Video Indexer. The codebook in the appendix is based on the interview questions. Deductive coding is a top-down approach that allows testing the existing taxonomy using the data.

The coding process involved three main stages: open coding, axial coding, and selective coding. Open coding was used for the initial coding of raw data to identify key concepts and skills mentioned by participants (Corbin & Strauss, 1990). Axial coding grouped similar concepts into broader themes, focusing on context and relevance (Gioia et al., 2012). Selective coding integrated themes

into comprehensive dimensions to understand broader patterns and strategies (Corbin & Strauss, 1990).

### *3.6.1. Approach for Sub-RQ1: Identifying Needed Skills for CBMs*

To determine the skills required for CBM, a structured coding process was employed. The analysis began with a deductive approach, using a predefined coding scheme based on the skill taxonomy by Straub et al. (2023). Each interview transcript was reviewed to identify mentions of skills listed in the baseline taxonomy. The initial codebook was based on the 40 skills outlined by Straub et al. (2023) and this was applied to the interview transcripts to confirm the presence or absence of each skill.

Following the deductive phase, an open coding process was conducted to capture additional skills not included in the baseline taxonomy. As interview data were coded, skills, challenges or practical examples mentioned by participants were identified and labelled. These new skills were validated through repeated coding and cross-checking with interview data and literature to ensure all skills were categorised. After this, they were integrated into the existing taxonomy, resulting in an updated and skill set for CSUs.

### *3.6.2. Approach for Sub-RQ2: Relevance of Skills and Ecosystem Factors*

To understand why certain skills are particularly relevant, the analysis involved linking skills to external ecosystem factors. After initial open coding, axial coding was used to group first-order concepts into broader second-order themes (Gioia et al., 2012). Economic conditions, educational alignment and technological infrastructure were concepts that were grouped to identify patterns and connections. Each identified skill was then examined in relation to these ecosystem factors to understand their relevance.

This step involved a thematic analysis to explore the interplay between skills and external factors and how participants applied skills to address the external factor. Patterns and recurring themes were identified, emphasising how external factors influence the development and application of skills in CSUs. This analysis provided an understanding of the skills' relevance within the context of the GS. The findings were synthesised to create a narrative linking skills to ecosystem factors.

### *3.6.3. Approach for Sub-RQ3: Strategies to Bridge Skill Gaps*

To identify strategies employed by CSUs to bridge skill gaps, a selective coding approach was used (Corbin & Strauss, 1990). Building on the second-order themes, selective coding integrated these themes into broader aggregate dimensions (Gioia et al., 2013). Strategies such as in-house training, educational collaborations and role flexibility were identified and coded. These strategies

were cross-referenced with the interview transcripts. The identified strategies were categorised and synthesised to highlight how CSUs address skill gaps.

## 3.7. Reliability and Validity of the Research

### *3.7.1. Reliability*

To ensure the reliability of this research, the framework proposed by Lincoln and Guba (1985) was applied, focusing on the criteria of dependability. Dependability parallels the concept of reliability in research, which concerns the consistency of the method in measuring the intended phenomena. To secure dependability, the sample and sampling methods were balanced and documented, ensuring that the research process can be replicated. The provision for dependability includes an in-depth methodological description, allowing other researchers to repeat this study. Throughout the research, methods were used and triangulation was applied by incorporating different data sources to enhance reliability. Furthermore, to limit the subjectivity inherent in qualitative research, the coding process and codes were frequently reviewed and discussed with the supervisor. This included independently coding several representative articles and refining the coding scheme based on recommendations from both the supervisor and an external researcher.

### *3.7.2. Validity*

Validity in this research was ensured by addressing the criteria of credibility, confirmability and transferability as outlined by Lincoln and Guba (1985). Credibility refers to the trustworthiness of the research findings, which was addressed by using appropriate research methods and triangulating data the interviews with literature reviews. The -lack of- entrepreneur experience of participants can influence the trustworthiness due to unconscious incompetence and not being able to identify relevant resources, as outlined by Weele et al. (2017). By inquiring about their experience at the beginning of this interview, this factor is addressed. Confirmability involves the objectivity of the collected data. This was ensured by defining a clear scope for the research, using an interview guide and implementing a coding scheme. The coding process was reviewed and revised based on insights gained during the analysis to make sure that the data interpretation remained objective and unbiased. Transferability is related to the generalisability of the research findings to other settings and contexts. Although the study focused on specific cases within the Africa, there is something to be said about the transferability due to the context of the CSUs. To protect the generalisability, the research collection and analysis process was described in detail, allowing other researchers to apply the findings to similar contexts.

## 3.8. Ethical Issues

To uphold ethical standards, the study initiates with informed consent, ensuring interviewees are fully informed and willingly participate. Participants receive an interview consent form from which they will be asked to read and sign -a copy of this form is found in Appendix E-. All collected data undergoes anonymisation and is securely stored in compliance with GDPR regulations, prioritising confidentiality and limiting access to exclusively the researcher. To maintain privacy, the interview process avoids disclosing personally identifiable information. Stringent measures, including encryption and restricted access protocols, are implemented to secure data integrity during storage, transmission, and analysis, aligning with established ethical guidelines.

# 4. Results

In this section the main insights are described that were derived from the study, which is structured along three parts: the needed skills (4.1.), why these skills are relevant by linking them to external factors (4.2) and lastly, which skill gaps are found under the CSUs (4.3.).

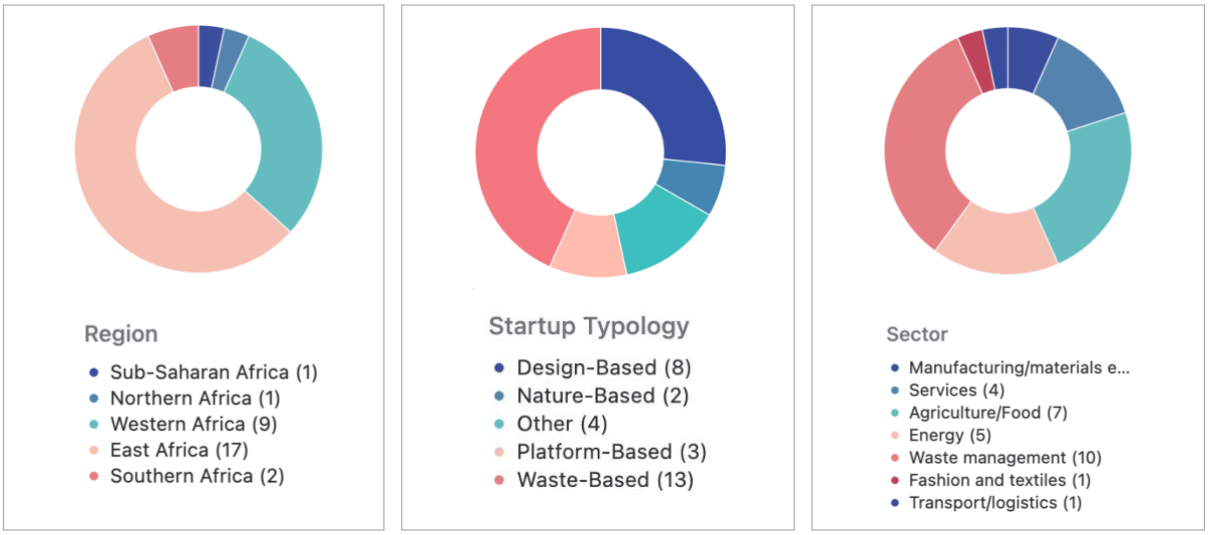


*Figure 4, Overview of CSUs by region, CSU typology according to Henry et al. (2020) and sector (Source: Author)*

Figure 4 shows a summarised overview of the sample. Below in Figure 5 is a visualisation of the founder's experience, where some have over 10 years of entrepreneurial experience. No interviewee had less than 4 years of experience in entrepreneurship, the sample allows for further analysis on the start-up skills needed, which addresses the research of Wasdani & Mathew (2014), who classify entrepreneurs beyond 3 years as late-stage entrepreneurs who are capable of opportunity recognition. Across the CBM archetypes, no patterns were found.

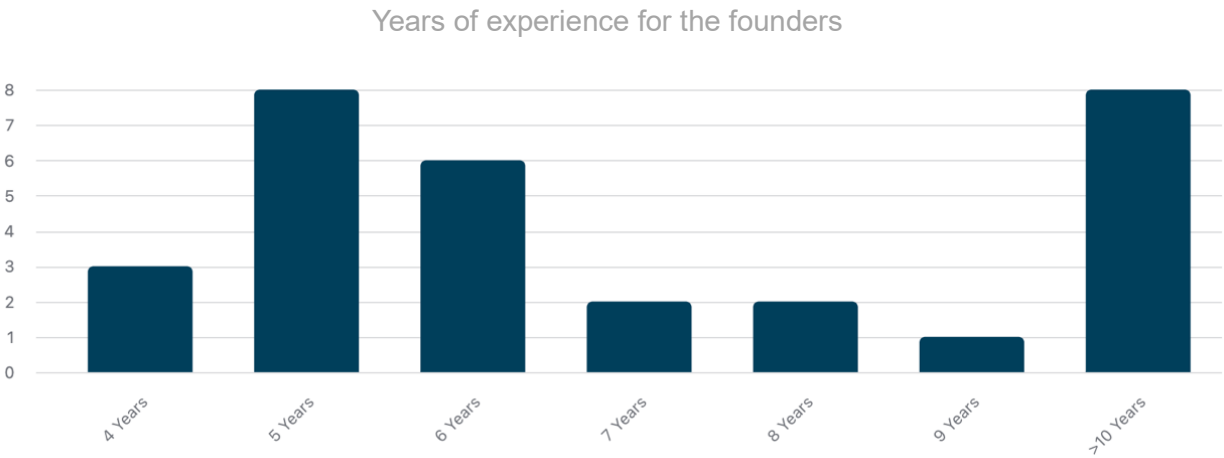


*Figure 5, Years of experience with the number of participants on the Y-axis (Author: Source)*

## 4.1. Needed Skills for CSUs

The skills required for CSUs have been organised into the following categories: those identified through the baseline taxonomy, additional skills derived from emerging themes and response analysis, and adapted skill types specific to the circular context.

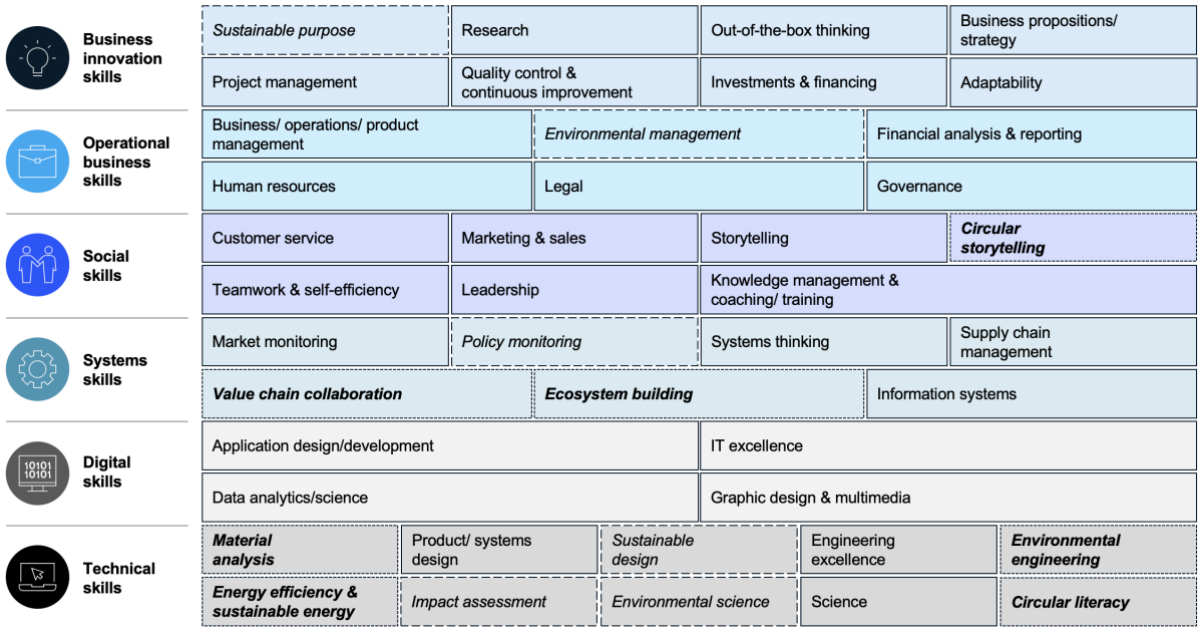


*Figure 6, Adapted skill taxonomy. Sustainability/environmental skills are italicised with a long-dash outline; circular skills are italicised and bolded with a short-dash outline; all other skills are general. (Source: Author)*

### *4.1.1. Needed Skills from Baseline Taxonomy*

The skill taxonomy is updated based on the analysis of needed skills, see Figure 6. Participants recognised the 40 skills comprehensively as needed; founders did not remove any skills from the taxonomy. All 30 participants recognised the skills needed for day-to-day operations and overall business functionality and analysis was able to link them to capabilities that supported the operation of their CBM.

"*Some are higher in priority and some are less in priority, but they're all needed over time and they change the turntables. Not to say that these all these skills are always required, in some cases they're more critical than other times.*" (Participant 10, CEO)

Particular skills in the taxonomy are emphasised in specific CSU archetypes. Waste-based CSUs predominantly mentioned technical skills that involve material analysis, energy efficiency & sustainable energy and environmental engineering. While CSUs did not always explicitly confirm material analysis as a needed skill, their business model involved extracting value from existing waste streams and evaluate materials on their circularity potential. Additionally, system skills are often mentioned that relate to supply chain management, value chain collaboration and ecosystem

building. Reason for this is that the waste-based model of CSUs involved collaborating with communities, informal waste collectors and integrating stakeholders into the value chain. The two nature-based CSUs both involved a business model that leverages local insects and turning this into proteins for animals. Technical skills as environmental engineering, energy efficiency & sustainable energy, environmental science, science and impact assessment are needed due to the businesses requiring specialist knowledge to capture value from natural sources that are difficult to obtain. For both nature-based CSUs, they applied scientific methods to apply it to the environmental challenges, as the founder below illustrates:

"*We are using black soldier flies to turn organic waste in protein for animal feed. We have a lot of organic waste that is produced in the market and in public places. This waste is contributing to the environmental provision, so we want to solve the challenge by turning it in ingredients for animal feed*." (Participant 22, CEO)

Regarding the eight design-based CSUs, problem-solving skills are often found and emerged as themes from the interviews. The design-based CSUs revolved about the development of a product in the pre-market phase, where out-of-the-box thinking, environmental management, supply chain management, ecosystem building, product/systems design, sustainable design, engineering excellence, impact assessment and environmental engineering were considered needed to be able to develop a product that implements one or more R-strategies. For the other-based CSUs, only one CSU was found to not working with waste-streams or local communities and provided different services. These CSUs provided consulting services to other CSUs and were involved with informal economies, or partners in the value chain. As Awan et al., 2021 & Kristoffersen et al., 2021 states, the three platform CSUs confirmed having a digital nature of the platforms and used data analytics are necessary to optimise its operations and enhance user experience. However, the CSUs operate in communities that do not always have access to the internet and therefore also visit the communities. Social skills, as customer service, storytelling, knowledge management and training were found to be valuable and involve the user in the platforms.

### *4.1.2. Added Skills to Baseline Taxonomy*

The analysis proposes 2 skills that emerged from the interviews: general literacy about CE and adaptability. These skills are linked to capabilities and analysis of the data showed that founders recognised it as needed within their business to operate their CBM. An overview is found in Table 4.

| Skill | Skill Type | New Definition |
|---|---|---|
| **Adaptability** | General | Adjusting strategies, operations and behaviours to respond to changing environmental, social, and economic conditions towards a CE |
| **Circular Literacy** | Circular | Understanding of CE principles and enabling stakeholders to implement sustainable practices that slow, close, and/or narrow material and energy loops |

*Table 4, New skills added to the baseline taxonomy (Source: Author)*

#### *4.1.2.1. Circular Literacy*

A recurring theme was that interviewees mentioned that they trained both their team as well as community members on the concept of CE, as their reasoning for this was that there is little knowledge and understanding which acted as a barrier for stakeholders to be involved in the business. A foundational understanding of CE principles was essential for the CSUs. This literacy enabled founders and employees to apply circular principles effectively, since their operations align with sustainability goals and promoting business models focused on resource efficiency and waste reduction. As the concept is not widely applied in Africa and people not having access to information sources, it is an additional element that needs to be trained on. The skill was trained through for example bi-weekly meetings, or incorporated in the onboarding process where the employees were learning or given time expand their knowledge.

*"We go to schools, we go to public gatherings and just to change their mindset from the linear economy to adopting to circular economy and sharing with them the benefits, but also with our Staffs. I mean when we on board them, most of them are not familiar with the idea of circular economy"* (Participant 30, CEO & Co-Founder)

Participants reported that lack of literacy about CE is a challenge and introduces a complexity for introducing a sustainable product to the end-user, which is in line with the theory of Kirchherr et al., (2017) and Young et al. (2017), who state that it is a challenge to create awareness among circular practices. Employees use circular literacy with other skills within the CSU, as for example "customer service" or "environmental storytelling". Through educating the end-user on the concept of CE, it taught them the relevance of it and a deeper understanding of why a circular product was a better alternative and was beneficial. While knowledge management & coaching and environmental storytelling is included in the taxonomy, circular literacy is required for stakeholders to understand the current -linear- system, the objective of CE and how to achieve a circular transition (Zwiers et al. 2020). As this skill facilitates the integration of circular practices in the business model, it is considered a sustainable skill. Obtaining circular literacy and sharing this with stakeholders and employees, the CSU addresses the barrier of lack of knowledge about the CE and encompasses the existing skills in the taxonomy. Circular literacy in the adapted taxonomy will be defined as "understanding of CE principles and enabling stakeholders to implement sustainable practices that slow, close, and/or narrow material and energy loops". Nonetheless, "knowledge management &

coaching/training" is not replaced by this skill as CSUs still need the foundational aspect of knowledge building that encompasses elements outside of the circularity aspect of the business.

#### *4.1.2.2. Adaptability*

All 30 founders reported the importance of this skill as they often experienced disruptions in their business operations and required to adapt. Power outages, regulatory changes and the CSUs operating under financial instability are found to be disruptions to day-to-day operations. CSUs must exhibit resilience and problem-solving to overcome these challenges.

"*Like for us working with more with rural communities is challenging. We always need to see how we can be flexible with different conditions. It's raining at one moment and it's very hot at one and in the next at the next training*." (Participant 5, CEO)

While out-of-the-box may have posed as an alternative for this, the application for this skill is different. The definition for out-of-the-box according to Straub et al. (2023) is "Developing original ideas for innovations and business improvements". In the context of which this skill is used, it involved adjusting behaviour and strategies to unforeseen occasions.

"*If you don't have money to buy a standby generator or a backup in a power source, then you must be very creative with how you run your operations. So, for us we have partnerships with some organisations, NGOs that feed the less privileged. Unfortunately, in in our country you are not giving an advanced notice before your power goes off*." (Participant 11, Co-founder)

Kodden (2020) refers to adaptability as "an individual's ability, skill, disposition, willingness, and/or motivation to change or fit the different task, social, or environmental features", which is considered as an important resource for employees who face new environments. In the context of the CSU, new and changing environments are often mentioned as challenges and barriers. Therefore, the added general skill is combined as 'adaptability' and defined as "adjusting strategies, operations and behaviours to respond to changing environmental, social, and economic conditions towards a CE".

### *4.1.3. Adapted Skill Types in Baseline Taxonomy*

Besides added skills, there are skills that are adapted due to the circular context that they were applied in. During the interviews, various skills classified as general skills were applied in a circular context in the CSU and had slight reframes which will be elaborated further below. Circular skills are defined as those that "cycle, extend, intensify, and/or dematerialise material and energy loops" (Geissdoerfer et al., 2020). See Table 5 below.

| Skill | Skill Type | New Definition |
|---|---|---|
| **Material analysis** | Circular | Evaluating materials regarding their circularity potential and optimising recycling, extending material lifecycles and improving the efficiency of material loops to support circular value chains. |
| **Value chain collaboration** | Circular | Creating and managing trust-based collaborations focused on maintaining value- and closing the loop within and beyond the supply chain, emphasising local resource retention, waste minimisation and the creation of closed-loop systems. |
| **Ecosystem building** | Circular | Actively linking actors to slow, close and/or narrow material and energy loops, building networks that achieve at-scale-circularity. |
| **Circular Storytelling** | Circular | Crafting engaging narratives that highlight the importance and benefits of CE practices, reinforcing the role of circular models in achieving sustainability and efficient resource management. |

*Table 5, Overview of adapted skill types (Source: Author)*

#### *4.1.3.1. Material Analysis*

Material analysis fits within this definition as it involves understanding, categorising, and optimising the use of materials to ensure they remain in the production cycle as long as possible. Material analysis is reclassified from a general skill to a circular skill, as CSUs actively applied it to the recycling, extending, intensifying, and dematerialising of material loops. Accurate material analysis supported them in optimising supply- and value chains by ensuring that the right materials are available at the right time, which supported them reducing waste and enhancing the circular flow of materials. The insights from the interviews illustrate how strategic partnerships and collaborations optimise material flows, local processing and drive improvements, all of which are essential for addressing R-strategies during the process. Especially with CSUs operating with informal waste collectors, as for example with the participant below:

*"If your collectors are not getting the right material, then of course you end up collecting wrong material. But if they know exactly what they're collecting, you start at the source, right? If your aggregators are buying the rights of material, we have to train them and that's why our development has been so slow, because we need to really have to penetrate these localities like deep, deep, deep travel, 10 hours, places right and from community to community."*
(Participant 2, Managing Director & CEO)

#### *4.1.3.2. Value Chain Collaboration*

While value chain is considered a general skill in the baseline taxonomy, in the context of CSUs in Africa, the value chain related to actively maintain value and increasing circularity. In the baseline taxonomy, value chain collaboration is defined as "Building and orchestrating trust-based win-win

collaborations along and beyond the supply chain". The circular application of value chain collaboration aligns with what Muchangos (2021) found, countries in the GS will soon get critical position in global circular value chains and will soon experience critical consumption level as they are becoming large generators of natural resources. In addition, there is already a circularity aspect in countries due to the limited resources that are present in the GS (Muchangos, 2021). Participants as shown below apply value chain collaboration to close the loop and collaborate with other companies to create win-win situations.

*"With try to do everything within the value chain. There are a lot of players in Uganda when it comes to plastic recycling, but most of them only end on the aspect of crushing the plastics into flakes and then exporting the flakes. So we are kind of different that we close that loop, we process the plates into final products as well. And by doing that, we retain most of the value. I mean, we retain all the value. From the recycling process within the same country and we try as much as possible to do it locally".* (Participant 30, CEO & Co-founder)

#### *4.1.3.3. Ecosystem Building*

Through actively working on ecosystem building by linking actors in the ecosystem together, CSUs aim to build a network of actors across an industry, country or continent and intensify, and/or dematerialise material and energy loops. Reclassifying ecosystem building as a circular skill is built on the argument that it plays a role in key circular elements of business, including closed-loop systems, local value retention and resource efficiency. The insights from the interviews illustrate how strategic partnerships and collaborations optimise material flows, local processing and drive improvements, all of which are essential for addressing R-strategies during the process.

"*I mean, if we take the side of Africa, the reality is that a lot of the ecosystem doesn't exist today or doesn't exist in any formalised way. I mean a lot of our work still today is around actually linking the different pieces of the ecosystem together. So you know, linking the chains, expanding the ecosystem. With that information, we work with our clients that optimise then those flows to say, OK, once material is gone through the value chain, how can we bring it back?"*
(Participant 21, CEO & Co-founder)

#### *4.1.3.4. Circular Storytelling*

Lastly, environmental storytelling is reframed to circular storytelling to reflect the approach needed for CSUs to communicate their purpose and impact. While environmental storytelling focuses on "engaging narratives that strengthen awareness of and support for sustainable CE" (Straub et al., 2023), circular storytelling encompasses the broader principles of the CE. This includes the sustainable use of resources, waste minimisation, and the economic and social benefits of circular

practices. This reframing ensures that the narrative aligns with the holistic goals of CE, making it a more effective tool for engaging stakeholders, attracting investment and educating the community about the full scope of circular initiatives.

"*Also regarding storytelling, this one is a key, especially for me when I go for pitching different presentation and also fundraising activities. So it goes hand in hand also with this storytelling because some like investors, they need to understand the environmental impact that you are going to have*". (Participant 13, CEO)

## 4.2. Particularly Relevant Skills

The capabilities of CSUs and their interactions with external ecosystem factors show how relevant skills are crucial for operating a CBM. During the interviews, participants provided explanations for utilising certain particularly relevant skills and skillsets considering pressing external factors. In specific, across all thirty CSUs four skills were recurring implicitly as well as explicitly as needed, being sustainable purpose, (environmental) storytelling, investment & financing and impact assessment. They were considered needed due to the capabilities they were linked to and how it supported the operationalisation of the CBM. Table 6 below presents the ecosystem factor that are linked to the skills.

| Ecosystem Factor | Skills that participants applied to address the ecosystem factor | How this skill was helpful to address external factor |
|---|---|---|
| **Lack of technological specialists** | Sustainable purpose | Motivated employees to stay despite better offers. |
| | Adaptability | Enabled CSUs to manage and mitigate the impact of skill shortages through flexible strategies. |
| | Circular literacy | Educated and empowered employees to adopt CE practices effectively. |
| | Human resources | Managed the recruitment and retention of talent despite limited availability of specialists. |
| | Knowledge management & coaching/training, | Built internal capabilities by continuously upskilling employees. |
| | Storytelling | Attracted and retained talent by effectively communicating the CSU's mission and impact. |
| **Competitive funding environment** | Sustainable purpose | Demonstrated a strong mission alignment that appealed to investors. |
| | Business propositions/strategy | Developed compelling business cases to attract funding. |
| | Investments & financing | Secured necessary funds through effective financial planning and proposal writing. |
| | Circular storytelling | Engaged investors by clearly articulating the environmental and social impacts. |
| | Impact assessment | Provided quantifiable data on sustainability impacts, bolstering funding applications. |
| | Value chain collaboration | Built strong networks and partnerships that increased funding opportunities. |

| | | |
|---|---|---|
| | Ecosystem building | Enhanced collaboration within the ecosystem, making funding more accessible. |
| **Lack of knowledge about CE** | Circular literacy | Educated stakeholders and employees on CE principles, fostering broader acceptance and understanding. |
| | Circular storytelling | Raised awareness and understanding of CE among potential customers and partners. |
| | Customer service | Ensured that clients understood the benefits of circular products and services. |
| | Leadership | Inspired and guided teams to align with CE goals and principles. |
| | Knowledge training & coaching, | Enhanced the skills and knowledge of employees, improving CE implementation. |
| | Ecosystem building | Fostered a supportive network of partners and stakeholders knowledgeable about CE. |
| | Impact assessment | Demonstrated the tangible benefits of CE initiatives, building stakeholder confidence. |
| **Technological- and infrastructure Limitations** | Adaptability, | Allowed CSUs to quickly adjust operations in response to infrastructure challenges. |
| | Business/operations/product management | Optimized resource use and maintained efficiency despite limitations. |
| | Supply chain management | Ensured reliable sourcing and distribution despite infrastructural issues. |
| | Project management | Coordinated projects effectively, mitigating the impact of technological and infrastructural constraints. |
| **Engagement with the informal economy** | Out-of-the-box-thinking | Developed innovative ways to integrate informal sector participants. |
| | Quality control and continuous improvement | Maintained high standards while working with informal sector inputs. |
| | Knowledge management & coaching/training | Provided essential training to informal sector workers, improving overall quality. |
| | Teamwork and self-efficiency | Fostered collaboration and independence among informal economy participants. |
| | Value chain collaboration | Built trust-based collaborations that integrated informal sector activities. |
| | Supply chain management | Coordinated the flow of materials between formal and informal sectors. |
| | Ecosystem building | Created supportive networks that included informal sector stakeholders. |
| | Storytelling | Raised awareness about the benefits of integrating informal sector efforts. |
| | Material analysis | Assessed and utilized materials sourced from the informal economy effectively. |
| | Circular Literacy | Educated informal sector workers on CE principles, enhancing their contributions. |
| **Uncertainties regarding policies** | Market monitoring | Kept track of market changes to anticipate and adapt to policy shifts. |
| | Policy monitoring | Stayed informed on regulatory developments, ensuring compliance and strategic adaptation. |
| | Adaptability | Enabled quick response to changing policy environments. |
| | Information systems | Leveraged technology to stay updated on policy changes and market conditions. |
| | Environmental management | Ensured compliance with environmental regulations and promoted sustainable practices. |
| | Legal, | Navigated the legal landscape to maintain compliance and mitigate risks. |
| | Governance | Established robust governance structures to handle policy uncertainties effectively. |

*Table 6, Overview of particularly relevant skills and the ecosystem factor*

### *4.2.1. Lack of technological specialists*

It is often concluded that there is a lack of technical skill supply. Nonetheless, CSUs need to keep operating their businesses and the interview data linked other skills from the taxonomy to address this external barrier. All founders underscore 'Sustainable Purpose' within CSUs to align with sustainability goals to drive strategies. It has shown to be a determining factor for some businesses that employees did not leave the CSU for a higher paying opportunity due to the strong sustainable purpose that was present in the business, as shown with the example below:

"*Evidence says of people (red: employees) who have received better offers, but stayed committed to the vision that we are running to*". (Participant 11, CEO & Co-founder)

This aligns with what Svensson & Wagner (2011) underscore in their study, who state that the sustainable mission of a start-up directly influences corporate behaviour, responsibility and performance. Besides sustainable purpose, this skill was combined with the other skills as mentioned in Table 7. It was applied with human resources, knowledge management & training and circular literacy: being able to recruit suitable employees, educate them about the CE and upskill their knowledge.

### *4.2.3. Competitive funding environment*

In all interviews, funding was a recurring theme and illustrated the difficulty in obtaining it as a CSU in Africa. Participants reported several causes for this and for those who set up start-ups both within and outside Africa, reported strong differences. Causes of this difficulty is originated in the lack of network -and thus ecosystem building-, uncertainty of the business model and a high number of CSUs that apply for a funding.

"*Actually for most, for most African status, it's not easy to get funded. No matter how skilled you are in telling your story and writing financial proposals, I think you need a good funder. A warm international most investors will require you to know somebody they have worked with, somebody who can give you a warm introduction to them. So it is a very tricky part especially for us who are just getting started*." (Participant 16, CEO)

Impact assessment is mentioned as critical for addressing the competitive funding environment. They enable CSUs to quantify and communicate the effectiveness of their operations in terms of environmental and social impact. Skills in conducting life cycle assessments and preparing sustainability reports are mentioned for justifying the business case to investors and stakeholders, which connects the business proposition/ strategy as well due to the requirement of having a clear business case. These skills help CSUs articulate the benefits of their CBMs and relates to an

intrinsic element of CBM and that it needs to driven by sustainability objectives, but also two more factors of securing talent and receive funding.

"*I think that we have found that, impact assessment has really been quite valuable in terms of being able to attract different types of stakeholders, both government and funding*."
(Participant 19, President & Co-founder)

Circular storytelling emerges as a recurring needed skill for CSUs. It involves crafting and creating narratives that connect stakeholders with the circular purpose of the CSU. This skill is essential for marketing, educating and engaging various stakeholders, including customers, investors, and community members.

#### *4.2.4. Lack of knowledge about CE*

Participants reported that lack of knowledge brings challenges. It is already elaborated that literacy about CE is a skill that participants actively apply -besides ordinary knowledge management & coaching/training- to share a CE narrative among actors in the ecosystem. This not only requires circular literacy, but also leadership, as the founder of a CSU inspires individuals, teams, and/or their organisation to strengthen circular business performance.

"*Getting them to understand the broader context, is even the challenge. Let alone understanding what it means for them. But if they don't understand the broader context is going to be very difficult to sort of understand how that can apply to them and you know, and just how they can go about it*".
(Participant 2, CEO)

It serves as a tool for advocacy, promoting wider acceptance and support of CE principles. It is found in other CSUs as well that literacy about the CE is trained with employees and needed to provide products and services to a target audience that is not yet familiar with the concept.

#### *4.2.5. Technological- and Infrastructure Limitations*

Adaptability and business/operations/product management are critical for CSUs operating in environments with technological and infrastructure limitations. CSUs are forced to adapt to operational challenges, as for example extreme weather conditions, power outages and lack of communication tools.

"*We're heavily affected by climate change. We don't have the infrastructure to deal with it in the same way like the Netherlands does*". (Participant 21, CEO & Co-founder)

Skills that are necessary for managing business continuity and efficiency in day-to-day operations, despite the limitations that are present in the ecosystem. For example, another participant in Ghana described how the CSU applies project management to account for the associated changes as well as along the supply chain.

"*The environment and the economic landscape is not stable as well in terms of electricity. So, we have problems with electricity and you need to constantly be we be innovating in your business operations. And in my case it is from raw material procurement all the way to the finished product*."
(Participant 11, CEO & Co-founder)

Technological- and infrastructural limitations are not unique to Ghana alone. Participants that are located in Nigeria, Tanzania, Ghana, Kenya and Uganda reported similar challenges and addressing this in their day-to-day operations. CSUs adapt their supply chain to these situations to minimise negative impacts.

#### *4.2.6. Engagement with the informal economy*

As stated in the theoretical background, Africa has the largest informal sector (Medina & Schneider, 2019; Ulyssea, 2020) and therefore engagement with the informal sector is almost inevitable for CSUs. Analysis showed that 26 out of 30 founders reported working with the informal economy, which uncovered appliances of skills in a specific context that is not known in GN. As stated in the theoretical background, Africa has the largest informal sector (Medina & Schneider, 2019; Ulyssea, 2020) for which participants used a combination of skills that supported them in their business practices, while capturing value from the part of the economy that is not yet formalised. One skill is value chain collaboration, which involves building and orchestrating collaborations along and beyond the supply chain. This skill is essential for incorporating informal waste collectors and local communities into the formal business processes of CSUs, alongside ecosystem building. Coupled with storytelling and circular literacy, quality control and continuous improvement are also applied to ensure that materials sourced from the informal sector meet the required standards for recycling and reuse.

"*We collect the waste from the environment, but also we conduct some community campaigns and training to the community to make sure that, for example, we are currently now training them how to sort the waste from the source and also avoiding some dangerous or toxic waste*."
(Participant 22, CEO)

Furthermore, knowledge management and coaching/training are critical for disseminating CE principles and practices within the informal sector. This involves implementing stringent quality checks and training informal workers to adhere to these standards. Another relevant skill is out-of-

the-box thinking, necessary for developing solutions to navigate the complexities of the informal economy. This includes adapting to supply conditions and creating business models that can respond to the nature of informal sector activities.

#### *4.2.7. Uncertainties regarding policies*

Uncertainties regarding policies present a external factor affecting CSUs in Africa. Participants highlighted the need for continuous policy monitoring and adaptation to address regulatory matters, which is in line with the findings of Khan et al. (2020), who also find that legal skills are needed for CBM. The statement by the participant below underscores the necessity for robust policy monitoring mechanisms within CSUs to stay updated on regulatory changes and proactively adapt strategies accordingly.

"*At the policy level, there's not been a lot of policy to address circularity or maybe open up the opportunity there in the circular economy. Because beyond addressing the environmental concern, these are new opportunities for start-ups or for government to find new approaches to doing things differently in a way that it's safe for the environment*" (Participant 8, CEO).

Henry et al. (2020) stated that the waste-based archetype is often faced by a lack of legislative clarity. Neither participant 8 or 14 are classified as a waste-based archetype and yet policy is mentioned as a relevant skill for addressing opportunities and approaches in CE. While already stated under 'engagement with the informal economy', 26 CSUs in Africa incorporate value capturing from waste streams, where it can be found that not only the waste-based archetype suffers from lack of legislative clarity.

## 4.3. Analysis of Identified Skill Gaps

The data from interviews suggest multiple contributing factors to these skill gaps. A factor is the alignment, or lack thereof, between educational outputs and market needs. Participants frequently cited that the educational system tends to prioritise theoretical knowledge over practical skills, which does not align well with the dynamic requirements of CSUs. This educational misalignment leaves a gap in skills, particularly in technologically driven sectors, where engineering skills are needed. This section first discusses the external factors that act as barriers, followed by the second section that discusses strategies of CSUs to close skill gaps.

#### *4.3.1. External Factors as Barriers*

Table 7 presents the external factors that act as barriers for the CSUs.

| Skill Gap | External Factors that act as barriers |
|---|---|
| **Engineering excellence** | Educational misalignment, economic factors |
| **Environmental engineering** | Educational misalignment, novelty of CE sector |
| **Environmental Science / Science** | Economic factors, novelty of CE sector |

*Table 7, Overview of external factors that act as barriers (Source: Author)*

#### 4.3.1.1. Educational Misalignment

It is reported that current educational system emphasises theoretical knowledge over practical skills, which does not meet the dynamic needs of CSUs. This gap is present with technical skills. For example, participants noted that while new graduates have strong theoretical backgrounds, they often lack the hands-on experience needed to address real-world challenges in waste management and recycling.

"*We're trying to encourage youths now and we're going creating a circular innovation park, which would have aspects of literally training youth to embrace, you know, natural sciences. Because if we can understand how to use material around us. I think we could solve a lot of problems*." (Participant 2, Managing Director & CEO)

#### 4.3.1.2. Economic Factors

Competition with international firms for talent who offer higher salaries and better benefits, makes it difficult for CSUs to attract and retain employees. Founders frequently mentioned that they struggle to find skilled professionals willing to work for lower salaries offered by CSU, as illustrated with the following example:

"*Challenges with training in the country people are, you know, running away from Africa, especially Nigeria. So they're all coming down to Europe and the US is well as Canada. So it's a tough challenge, but you know without human resources, we can't make any kind of success and progress*" (Participant 29, CEO)

#### 4.3.1.3. Novelty of the CE in Africa

The emerging nature of CE means there is a limited pool of specialists. This is especially true for specialised skills such as environmental engineering, where the novelty of the sector creates a knowledge gap. Interviewees pointed out that many universities have only recently begun to incorporate CE principles.

"*In our economy, people don't even have enough knowledge of those concepts and why we should be circular in our business as against linear. It's a concept that needs a lot of education*" (Participant 6, CEO)

### *4.3.2. Strategies to Close Skill Gaps*

Table 8 below presents an overview of strategies that were identified in the interviews to close skill gaps that were present in the CSUs. The strategies are either focused on skill development, or partnerships with other actors within the ecosystem.

| Strategy | Description |
|---|---|
| **In-house training** | Developing and implementing training for new and existing employees |
| **Collaborations with (educational) institutions** | Partnering with universities to get access to resources that CSUs are unable to obtain for themselves due to financial constraints |
| **Role flexibility and outsourcing roles** | Training employees to perform multiple roles to enhance operational flexibility, utilising external expertise and advanced technology to fill skill gaps |

*Table 8, Overview if strategies pursued by CSUs to close skill gaps*

#### 4.3.2.1. In-house training

CSUs are developing intensive in-house training programs to upskill new recruits and continuously develop existing employees' skills. This strategy addresses skill gaps and enhances employee retention by investing in career development. It is also a strategy that CSUs pursue to adapt to the economic factors, where specialised individuals leave the country for a job in the GN.

"*What we have seen is some of the engineers we've got, you know, came from the university in time with us, then take them on maybe three years down the road. You know, once they have increased us because when you are working with start-ups, you're not working. Especially they end up like getting better opportunities. Of course, bigger start-ups from the continent or in Europe and others*". (Participant 27, CEO)

Another example, a CSU in Tanzania offers an internship program where the intern receives training within the business while not being specialised yet in the technical skill set.

"*Retaining talent is very difficult, getting someone who has experience, who has the passionate about the business also difficult. So I thought like myself, what if someone goes through internship*

*before we even hire them and then I use the same technique. So you have to go through internship first before we can hire you*." (Participant 17, CEO)

#### 4.3.2.2. Collaborations with Educational Institutions

Forming partnerships with educational institutions is for CSUs a strategy that supports the ecosystem of likeminded actors, as well as access to resources that would otherwise not be accessible:

"*And mostly what you do, for example in the quality control & the continuous improvement, we have partner with University of Dar Es Salaam where we do the quality check for our feed and for our biomass protein*." (Participant 17, CEO)

Especially for waste-based and nature-based CSUs in technical sectors, this was found to be a strategy to mitigate gaps in terms of technical knowledge.

#### 4.3.2.4. Role Flexibility and Outsourcing Roles

Promoting role flexibility along with outsourcing within teams allowed CSUs to improve adaptability and reduce vulnerability to skills gaps. Training employees to handle multiple roles improved operational resilience. Additionally, outsourcing and the integration of advanced technological solutions also served as strategic responses to bridge gaps in specialised areas where expertise is scarce. This enables CSUs to maintain operational efficiency without extensive recruitment. One CSU trains their staff in both administrative and technical roles, ensuring that operations continue smoothly even when facing staff shortages. Another example where the research team of one CSU taking on operational skills besides technical and business innovation skill sets:

"*It's part of the research team's work to handle policy monitoring, but we are hoping that by some time when we grow further, we'll have a dedicated policy review team to always track policies and programs that are coming by government and be able to advise management on the way forward and also participate in policy review meetings by government*" (Participant 14, CEO & Co-Founder).

To a certain extend this can be linked to the findings of Tibaingana et al. (2023), that conclude that sustainable start-ups require a well-rounded set of skills to foster their business. Integrating role flexibility and/or outsourcing, allows the CSU to close skill gaps and improve efficiency.

# 5. Discussion

This chapter discusses the observations drawn from the results, addresses the research limitations, and provides recommendations for entrepreneurs in African economies, policymakers, and scholars.

## 5.1. Theoretical Implications

This study identifies novel circular skills previously considered general skills, reframing (1) material analysis, (2) ecosystem building and (3) value chain collaboration as circular skills. While Straub et al. (2023) classified these as general skills applicable in both linear and circular businesses, this research finds that the context in which these skills are applied within CSUs are specific to the CBM and applied to cycle, extend, intensify, and/or dematerialise material and energy loops (Geissdoerfer et al., 2020). The interview analysis showed that value chain collaboration in CSUs involves creating closed-loop systems and improving local value retention, which differs from its application in linear businesses. This finding aligns with the theoretical perspective that CBM require a different approach to managing supply chains, emphasising local resource use and waste minimisation (Geissdoerfer et al., 2018; Kanda et al., 2021).

Similarly, material analysis, defined in the baseline taxonomy by Straub et al. (2023) as “evaluating materials regarding their circularity potential”, is reconceptualised in this research. Within CSUs, material analysis encompasses recycling, extending, intensifying, and dematerialising material loops, actively extending material lifecycles rather than evaluating their potential for circularity. This finding supports the notion that technical skills in material analysis and environmental engineering are crucial for the practical implementation of CBMs, as noted in literature (Straub et al., 2023).

Straub et al. (2023) found various capabilities and skills suggested in CSU literature, which were not found within their quantitative analysis of skills under employees of CSUs. Notably, in this research, skills as “flexibility and adaptability” emerged as needed skill for CSUs and added to the taxonomy under “adaptability” which indicates a possible gap between theoretical skill requirements and the actual skills present in CSU employees. Other circular skills found in Straub et al’s (2023) study are industrial and internal symbiosis, design for servitization /PSS, production planning flexibility and principles of CE. While the skill circular literacy could be identified as similar with principles of CE, the latter was linked to the capability of value retention/recovery and circular literacy is linked to the capability of understanding the general concept of CE. Not identifying the design for servitization/PSS in this research could be explained by the lack of service-based start-ups, for which this is the core of the business model (Henry et al., 2019)

The empirical data further emphasises the importance of adaptability, particularly in the African context, where CSUs face challenges such as infrastructural deficits and economic instability. Participants frequently mentioned the need for adaptability in managing these challenges. This resonates with the theoretical framework suggesting that dynamic capabilities, including adaptability and resilience, are critical for the success of start-ups operating under resource constraints (Teece, 2007; Kodden, 2020). Moreover, the integration of circular literacy and circular storytelling emerged as skills for educating stakeholders and securing support for circular initiatives, which emphasises the role of communication in fostering a CE (Zwiers et al., 2020; Sumter et al., 2020).

It was expected that contributions or additional skills related to digital skills would emerge during this research, however no adaptations to the baseline taxonomy are made. When analysing the responses of participants regarding the general digital skills, their necessity was confirmed, but only a few were recognising it as an enabler for accelerating to CE. One possible reason for this is that African nations face a divide in digitalisation due to a lack of infrastructure, lower skill levels and high costs (Naudé, 2017). Due to this divide in digitalisation, it could be suggested that the participants engage less with digital skills.

It was found that CSUs leverage skills as out-of-the-box thinking, adaptability, sustainable purpose, ecosystem building and impact assessment to overcome and decrease skill gaps. This deviates from the traditional barriers of funding and policy support often emphasised in the literature (Konietzko et al., 2019). Nonetheless, these traditional barriers are also recognised and considered a barrier by the CSUs. This finding contributes to the theoretical understanding of skill development in CSUs by highlighting the strategies employed by start-ups in resource-constrained environments. It challenges the prevailing notion that external support is the primary driver of skill acquisition in developing regions and underscores the importance of internal capabilities.

The study underscores the necessity of both general and specific skills for effective CBM implementation. For example, logistics skills are essential for reverse logistics activities within circular models, while value chain collaboration is critical for supporting industrial symbiosis. However, the lack of explicitly declared circular skills among employees suggests a gap in how these skills are framed and recognised. This could hinder the broader adoption and operationalisation of CBMs, which confirms the findings by Straub et al. (2023). Moreover, the reliance on general skills such as adaptability and creative problem-solving indicates that CSUs in Africa often operate in highly dynamic environments. The need to pivot and innovate constantly is driven by external factors such as technological and infrastructural limitations, which necessitate a robust set of adaptable skills. This observation aligns with capability theory, which posits that skills

must be complemented by processes, technology, and organizational structures to enable effective CBM implementation (Barney and Felin, 2013).

Lastly, it is highlighted that, on the one hand, many skills for circular businesses are universally applicable, regardless of geographical location. Interviewees frequently mentioned that the skills found in European CSUs are also important for their operations. This suggests a core set of skills essential for circular businesses globally. However, on the other hand, certain skills are particularly relevant in specific geographical contexts due to external factors such as local infrastructure, economic conditions, and regulatory environments. The importance of circular literacy and storytelling in the African context underscores the role of effective communication in promoting CE practices. Given the relatively nascent stage of CE adoption in many African countries, educating stakeholders and securing their support is crucial for the success of CSUs. This contrasts with regions where CE practices are more established and the focus may be more on optimising existing processes rather than foundational education.

## 5.2. Limitations and Suggestions for Future Research

Like all research, this study has several limitations that deserve further investigation for future studies. First, the subjectivity inherent in qualitative research introduces potential biases from both the researcher's interpretation and participants' responses, which can introduce a limitation in the reliability of the findings. The interviews were conducted at one point in time and therefore does not include how needed skills change over a period and which skills can be found more important than others, especially during different stages of a start-up. Longitudinal research within CSUs is therefore needed to identify whether these dynamics change and how it affects the CSU.

Secondly, although the experience of the participants was verified to ensure reliability, this research primarily used qualitative methods and did not quantitatively connect the identified skills to the performance metrics of the CSUs. Consequently, this research unable to determine which skills are most critical for success through statistical analysis. Future research could address this limitation by employing quantitative methods to link specific skills to the performance outcomes of CSUs. By doing so, it would be possible to identify the most impactful skills and refine the skill taxonomy accordingly.

Lastly, Africa's cultural and economic diversity means that findings from one region may not apply to another, affecting the external validity of the results. The insights gained are specific to the participants in this study and may not fully represent CSUs in other regions of the continent. Therefore, more research is needed across different African economies to ensure broader applicability.

In addition to address these limitations in future research, it is suggested that the future research direction Such efforts could identify key milestones in the development of CSUs where entrepreneurs increasingly recognise skill gaps and develop necessary skills. These milestones would enable support organisations and educational institutions to tailor their training and support programs more effectively to meet the specific needs of CSUs.

## 5.3. Recommendations

This thesis extends current theoretical insights on CBMs for CSUs by providing an analysis of the needed skills, external factors influencing the CSU and strategies employed to overcome these gaps. The main scientific contribution of this research is the identification and analysis of the specific skills required for CSUs in Africa to operate CBMs and which skills are particularly relevant in the light of certain context-specific factors. The latter is critical for policymakers to understand what CSUs encounter and how effective policy can be developed. It presents skill gaps and strategies utilised by CSUs by validating and expanding upon the baseline taxonomy proposed by Straub et al. (2023) within the context of Africa.

The study provides insights for CSUs operating in Africa should focus on continuous learning and development within their organisations. Collaborating with local institutions and building an ecosystem of specialists, they can address technological skill gaps. Emphasising a sustainable purpose is found to be efficient in multiple areas, as it helps attract and retain talent while also appealing to investors focused on sustainability. Scholars are encouraged to bridge the research gap identified in this study by focusing more on the specific skills and capabilities required for CBMs in the African context. Future research should explore the opportunities faced by CSUs in Africa, providing empirical evidence and practical frameworks that can guide both entrepreneurs and policymakers. Lastly, policymakers can address the educational misalignment, ensuring that the workforce is adequately prepared for the demands of the CE by promoting collaborations between educational institutions and industry.

# 6. Conclusion

This research investigated how CSUs in the African economies develop and leverage the necessary skills to operate a CBM. Through interviews with CSUs across nine African countries, the study extended a skill taxonomy, identified relevant skills, addressed external factors that act as a barrier to CBM implementation and explored approaches for skill development and utilisation. The main research question of this study was: “How do circular start-ups in African economies develop and apply the needed skills to operate Circular Business Models?”

CSUs in African economies develop needed skills through training programs for employees, collaborations with (local) educational institutions & industry experts and promoting role flexibility within their teams to adapt to changing conditions and demands to operate a CBM. The study adds adaptability and circular literacy as skills for CSUs to navigate resource limitations and spread awareness about CE. Certain skills are found to be particularly relevant because they actively address external factors CSUs are faced with, for instance infrastructural deficits and economic instability. While engaging with local communities and stakeholders through circular literacy and storytelling enhances awareness and support for CE in African economies, skills like sustainable purpose and impact assessment are applied to attract funding and stakeholder support. Lastly, the study found that the development and application of skills in CSUs are influenced by the local ecosystem, which creates potential skill gaps. CSUs aim to close skill gaps by pursuing various strategies related to skill development and external partnerships.

In conclusion, CSUs in the African economies require a strategic approach involving adaptive business practices to operate and sustain CBMs effectively. This study advances the understanding of CE skills and CBM concepts by proposing an adapted skill taxonomy tailored to CSUs in Africa. While the adapted skill taxonomy serves as an analytical tool tailored to CSUs in Africa, it is not intended to be definitive but subject for further research. This study aims to encourage more researchers to explore the skills needed for CBM implementation in the contexts of the GS and emphasising its significance and potential for advancing CE practices.

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# Appendices

## APPENDIX A

Outreach e-mail to business owner of a CSU.

**OUTREACH EMAIL**

Dear [Owner/Founder's Name],

I hope this message finds you well. My name is Quinty van Niel, and I am currently pursuing my master's thesis at Utreccht University with a focus on employee skills for circular startups in Africa.

I am reaching out to you because of the admirable work your company [Company Name] is doing in the realm of circular waste management. Your innovative approach and commitment to sustainability have inspired my research.

I am conducting interviews with esteemed founders and owners of circular startups, aiming to delve into the essential skill sets required to operate and thrive in this industry. Your valuable insights and experiences would greatly contribute to the depth and richness of my research.

I believe your participation in this interview would be highly beneficial for both the research and your company, providing valuable insights into:

- Specific skills and capabilities crucial for operating a successful circular waste management startup.
- Understanding the skill gaps and areas for development within your organisation.
- How to find and nurture the right talent for sustainable business growth.

The interview will take approximately 60-90 minutes and will cover topics such as:

- Operational challenges faced in the circular waste management sector.
- Essential skills needed for efficient business operations.
- Strategies for talent acquisition and skill development.

Your expertise and insights are highly respected, and your contribution to this research would be invaluable. I assure you that all information provided will be handled with the utmost confidentiality and used solely for academic purposes.

I am flexible and willing to accommodate your schedule. Please let me know a convenient time for the interview, and I will ensure to adjust accordingly.

Thank you for considering this invitation. Your support in this research endeavor would be deeply appreciated.

Looking forward to the opportunity to learn from your expertise.

Warm regards,
Quinty van Niel

# APPENDIX B

Reactivation email to the business owner.

**REACTIVATION EMAIL**

Dear [Owner/Founder's Name],

I hope this message finds you well. I wanted to circle back regarding the invitation I extended to you last week to participate in an interview for my master's thesis on circular waste management startups in Africa.

I understand that running a business involves numerous commitments and demands on your time. However, your insights and experiences in the field of circular waste management are invaluable to my research, and I would greatly appreciate your participation.

The interview aims to explore the crucial skill sets required to operate and succeed in the industry. Your input would not only contribute to the academic depth of my thesis but could also provide actionable insights for your company's growth and talent strategies.

If you haven't had the chance to consider the invitation yet, I would be grateful for a moment of your time to discuss the interview and its potential impact further.

I remain flexible and willing to adjust to your schedule. Please let me know a convenient time for the interview, and I'll ensure it aligns with your availability.

Thank you for considering this opportunity. Your involvement would be immensely valuable.

Looking forward to the chance to connect and learn from your expertise.
Warm regards,
Quinty van Niel

# APPENDIX C

Interview Guide

| |
|---|
| **General Introduction :**<br>“Thank you for taking the time to get on this call. I am conducting this research for my master's thesis and have reached the point where I discovered that there is very little research on how skills are applied in start-ups in the global south. Therefore, I am looking for more context by talking to owners. The framework we will use during the interview is based on skills identified in Europe. The goal of the revised framework is to focus on the unique contexts of the global south (because there is still a lot unknown about this) and thus more effectively bring the right skills into a business.<br><br>Regarding the recording, please we have to make sure that only one person speaks at a time so that the recordings can be transcribed for analysis.” |
| 1) Could you please tell more about your role in the firm and your prior experience? |
| 2) What does your business do? |
| 3) Which of the skills from the taxonomy can you confirm as needed/relevant for your business? |
| 4) What is the top 5 that your organisation currently needs for running your business mode and why? |
| 5) For the skills you mentioned earlier, could you provide examples of how they are applied in specific job activities or functionalities within your organisation? |
| 6) Do you currently possess all of these skills? |
| 7) What are some of the challenges you face in finding the right skills for your organisation? Why do you not have these skills? |
| 8) How do you address the skills that are missing? |
| **Outro:**<br>“Thank you very much for taking the time to participate in this interview. If you have any further questions or need additional information, please feel free to reach out to me. Your contribution is appreciated and I look forward to possibly sharing the results with you once the study is completed. Thank you again, and have a great day!” |

# APPENDIX D

Copy of Informed Consent Form that will be used for the interviews.

## INFORMED CONSENT FORM (INTERVIEW)

In this study we want to learn about **Employee Skills in Circular Start-Ups**. Participation in this interview is voluntary and you can quit the interview at any time without giving a reason and without penalty. Your answers to the questions will be shared with the research team. We will process your personal data confidentially and in accordance with data protection legislation (the General Data Protection Regulation and Personal Data Act). Please respond to the questions honestly and feel free to say or write anything you like.

Everything you say or write will be confidential, and anonymous. This means that we do not ask for your name, and no one will know which respondent said what.

I confirm that:

- I am satisfied with the received information about the research;
- I have no further questions about the research at this moment;
- I had the opportunity to think carefully about participating in the study;
- I will give an honest answer to the questions asked.

I agree that:

- the data to be collected will be obtained and stored for scientific purposes;
- the collected, completely anonymous, research data can be shared and re-used by scientists to answer other research questions;

I understand that:

- I have the right to see the research report afterwards.

**Do you agree to participate?** o Yes o No

## INFORMATION SHEET **(INTERVIEW)**

### INTRODUCTION

You are invited to take part in this study on Employee Skills in Circular Start-Ups. The purpose of the study is to learn about skills. The study is conducted by Quinty van Niel who is a student in the MSc program Innovation Sciences at the Department of Sustainable Development, Utrecht University. The study is supervised by Dr. Julian Kirchherr.

### PARTICIPATION

Your participation in this interview is completely voluntary. You can quit at any time without providing any reason and without any penalty. Your contribution to the study is very valuable to us and we greatly appreciate your time taken to complete this interview. We estimate that it will take approximately 30-60 minutes to complete the interview. The questions will be read out to you by the interviewer. Some of the questions require little time to complete, while other questions might need more careful consideration. Please feel free to skip questions you do not feel comfortable answering. You can also ask the interviewer to clarify or explain questions you find unclear before providing an answer. Your answers will be noted by the interviewer in an answer template. The data you provide will be used for writing a Master thesis report and may be used for other scientific purposes such as a publication in a scientific journal or presentation at academic conferences. Only patterns in the data will be reported through these outlets. Your individual responses will not be presented or published.

### DATA PROTECTION

The interview is also audio taped for transcription purposes. The audio recordings will be available to the Master student and academic supervisors. We will process your data confidentially and in accordance with data protection legislation (the General Data Protection Regulation and Personal Data Act).

Audio recordings will be deleted when data collection is finalized, and all interviews have been transcribed.

Everything you say in this interview will be confidential and completely anonymous. This means that we will not ask for your name, date of birth, or other personal information that can be traced to you by us or a third party.

We will process your data confidentially and in accordance with data protection legislation (the General Data Protection Regulation and Personal Data Act)

# APPENDIX E

| *Interview No.* | *Role in Business* | *Experience Entrepreneurship* | *Country* | *Region* | *Startup Typology* | *Sector* |
|---|---|---|---|---|---|---|
| *No. 1* | CEO | >10 Years | South Africa | Southern Africa | Other | Manufacturing/materials eng |
| *No. 2* | Managing Director / Co-Founder | >10 Years | Ghana | Western Africa | Other | Services |
| *No. 3* | CEO / Co-Founder | 5 Years | Tanzania | East Africa | Nature-Based | Agriculture/Food |
| *No. 4* | CEO | 9 Years | Ghana | Western Africa | Design-Based | Energy |
| *No. 5* | CEO | 4 Years | Ghana | Western Africa | Waste-Based | Waste management |
| *No. 6* | CEO | 6 Years | Tanzania | East Africa | Waste-Based | Fashion and textiles |
| *No. 7* | CEO | 6 Years | Rwanda | East Africa | Platform-Based | Waste management |
| *No. 8* | CEO | 5 Years | Nigeria | Western Africa | Other | Services |
| *No. 9* | CEO | 7 Years | Kenya | East Africa | Waste-Based | Energy |
| *No. 10* | CEO | >10 Years | Uganda | East Africa | Design-Based | Waste management |
| *No. 11* | CEO / Co-Founder | 8 Years | Ghana | Western Africa | Design-Based | Agriculture/Food |
| *No. 12* | CEO | 5 Years | Rwanda | East Africa | Waste-Based | Services |
| *No. 13* | CEO | 6 Years | Nigeria | Western Africa | Other | Manufacturing/materials eng |
| *No. 14* | CEO / Co--Founder | 5 Years | Ghana | Western Africa | Design-Based | Services |
| *No. 15* | CEO | 6 Years | Kenya | East Africa | Design-Based | Waste management |
| *No. 16* | CEO | 5 Years | Egypt | Northern Africa | Waste-Based | Energy |
| *No. 17* | CEO | 4 Years | Tanzania | East Africa | Waste-Based | Agriculture/Food |
| *No. 18* | CEO | 5 Years | Côte d'Ivoire | Sub-Saharan Africa | Waste-Based | Waste management |
| *No. 19* | President / Co-Founder | >10 Years | Kenya | East Africa | Waste-Based | Agriculture/Food |
| *No. 20* | Marketing Director | >10 Years | Kenya | East Africa | Design-Based | Agriculture/Food |
| *No. 21* | CEO / Co-Founder | 5 Years | South Africa | Southern Africa | Waste-Based | Waste management |
| *No. 22* | CEO | 5 Years | Kenya | East Africa | Nature-Based | Agriculture/Food |
| *No. 23* | CEO | 7 Years | Uganda | East Africa | Design-Based | Transport/logistics |
| *No. 24* | CEO | 8 Years | Tanzania | East Africa | Platform-Based | Waste management |
| *No. 25* | Managing Director / Founder | >10 Years | Nigeria | Western Africa | Platform-Based | Waste management |
| *No. 26* | CEO | >10 Years | Tanzania | East Africa | Waste-Based | Energy |
| *No. 27* | CEO | 6 Years | Uganda | East Africa | Design-Based | Waste management |
| *No. 28* | CEO / Co-Founder | 6 Years | Tanzania | East Africa | Waste-Based | Energy |
| *No. 29* | CEO | >10 Years | Nigeria | Western Africa | Waste-Based | Agriculture/Food |
| *No. 30* | CEO / Co--Founder | 4 Years | Uganda | East Africa | Waste-Based | Waste management |

# APPENDIX F

| *Skill* | *Type* |
|---|---|
| *Environmental engineering* | Circular |
| *Energy efficiency and sustainable energy* | Circular |
| *Research* | General |
| *Out-of-the-box-thinking* | General |
| *Business propositions/strategy* | General |
| *Project management* | General |
| *Quality control and continuous improvement* | General |
| *Investments and financing* | General |
| *Business/operations/product management* | General |
| *Financial analysis and reporting* | General |
| *Human resources* | General |
| *Legal* | General |
| *Governance* | General |
| *Customer service* | General |
| *Marketing and sales* | General |
| *Storytelling* | General |
| *Teamwork and self-efficiency* | General |
| *Leadership* | General |
| *Knowledge management and coaching/training* | General |
| *Market monitoring* | General |
| *Systems thinking* | General |
| *Supply chain management* | General |
| *Value chain collaboration* | General |
| *Ecosystem building* | General |
| *Information systems* | General |
| *Application design/development* | General |
| *IT excellence* | General |
| *Data analytics/science* | General |
| *Graphic design and multimedia* | General |
| *Material analysis* | General |
| *Science* | General |
| *Engineering excellence* | General |
| *Product/systems design* | General |
| *Sustainable purpose* | Sustainable |
| *Environmental management* | Sustainable |
| *Environmental storytelling* | Sustainable |
| *Policy monitoring* | Sustainable |
| *Sustainable Design* | Sustainable |
| *Impact assessment* | Sustainable |
| *Environmental science* | Sustainable |