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Circular e-waste ecosystems in necessity-driven contexts: The impact of formal institutional voids

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Abstract

Recent studies suggest an ecosystem view is most appropriate for understanding the impact of institutional voids on entrepreneurial activities. Expanding the focus to the entrepreneurial ecosystem is crucial for tackling complex low- and middle-income countries' (LMICs) environmental challenges, as the transition to circular e-waste management, which are heavily impacted by the institutional environment. Moreover, most entrepreneurs in LMICs engage in circular practices out of economic necessity, rather than environmental reasons. However, scholars have overlooked the effects of institutional voids on entrepreneurial ecosystems' potential to grow and realize environmental benefits. This study investigates how formal institutional voids impact the evolution of circular ecosystems in necessity-driven contexts in LMICs. We study the evolution of a circular e-waste ecosystem in Kenya and uncover two key phases: emergence and growth. We show that formal institutional voids' impact differs across phases; regulatory and contract enforcement voids create opportunities for informal and private actors to establish e-waste collection, repair, remanufacture, and recycle businesses, thereby facilitating the emergence of the circular ecosystem. However, labor market, capital market, product market, regulatory, and contract enforcement voids hamper its growth. Specifically, the lack of skills, equipment, guidelines, and financial incentives hinders advanced repairs and remanufactures and limits recycling opportunities, while the lack of formal e-waste infrastructure increases illegal dumping and negatively impacts human health and the environment. We develop propositions and a phase model to explain the impact of formal institutional voids on the evolution of circular e-waste ecosystems and the realization of environmental benefits in necessity-driven contexts.

KEYWORDS

circular economy, e-waste ecosystems, informal entrepreneurship, institutional voids

1 | INTRODUCTION

Circular waste management is gaining in popularity as a solution to the growing waste problem in low- and middle-income countries

(LMICs), where resource constraints prevent effective waste management (e.g., Ferronato & Torretta, 2019; Gall et al., 2020). Several circular, resource-conservative practices can already be observed in LMICs, triggered by resource scarcity (Korsunova et al., 2022). Most

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entrepreneurs deploy circular practices due to economic necessity, rather than environmental reasons. Nonetheless, this has led to environmental benefits, such as the reduction of waste ending up at (illegal) dumpsites, where discarded materials, such as plastics and e-waste, contaminate soil and water, damage crop yields, and threaten food security (Asante et al., 2019; Jambeck et al., 2018). Examples of such entrepreneurial activities include repairing electronics and home goods, smelting plastics into construction material, or repurposing used tires into chairs. Many of these entrepreneurs face context-specific formal institutional voids (Härri et al., 2020), defined as “the absence or underdevelopment of formal institutions that enable and support market activity” (Doh et al., 2017, p. 1), such as financial institutions, quality certification firms, an enabling regulatory framework, and control-enforcement mechanisms (Khanna & Palepu, 2010).

Extant literature has conceptualized institutional voids both as a driver and barrier for (circular) entrepreneurship in LMICs (e.g., Brix-Asala et al., 2021; Heuer et al., 2020). Studies show that formal institutional voids, such as the absence of specialized human capital or functioning financial markets, hinder entrepreneurs from developing their businesses (e.g., Puffer et al., 2010; Saka-Helmhout et al., 2020). Conversely, other studies suggest that entrepreneurs can leverage institutional voids to set up their commercial activities (e.g., Korsunova et al., 2022; Sydow et al., 2022; Tracey et al., 2011).

While valuable to gain differing perspectives on how institutional voids impact entrepreneurship, both streams of literature share common limitations. First, existing research emphasizes entrepreneurs addressing social issues, while it overlooks the relevance of institutional voids for entrepreneurial efforts aimed at tackling environmental challenges in LMICs (e.g., Betancourt Morales & Zartha Sossa, 2020). Second, most studies focus on single enterprises (e.g., Puffer et al., 2010; Saka-Helmhout et al., 2020; Sydow et al., 2022), while only a few hint at the importance of an ecosystem perspective for understanding how entrepreneurs are enabled or constrained by a specific institutional context (e.g., Cobben et al., 2022; Stam, 2015). Expanding the focus to the entrepreneurial ecosystem becomes crucial for investigating complex environmental problems in LMICs, such as the transition to circular waste management, which require collaboration among multiple stakeholders. However, these studies solely focus on how entrepreneurs, engaged in circular activities, deal with institutional voids to establish themselves, rather than investigating how institutional voids affect the evolution of circular activities, i.e., their development over time. Growth is critical for circular ecosystems, because the environmental impact reached through circular activities largely depends on the size of the ecosystem (Aarikka-Stenroos et al., 2021). Moreover, the growth of a circular ecosystem in a necessity-driven context is often merely driven by the value capture potential that entrepreneurs see, rather than aiming for positive environmental impact. Yet prior research does not offer insights on the influence of institutional voids on the growth of a necessity-driven circular ecosystem and its long-term environmental impact.

Stemming from these gaps in extant research, this paper answers the following research question: *how does the presence of institutional voids impact the evolution of circular ecosystems in necessity-driven contexts?* To answer this research question, we adopted a single case study

approach and selected the case of the electronic appliances ecosystem (or “e-waste ecosystem” in short) in Kenya. Kenya is an appropriate case to study, since the amount of e-waste here is rapidly increasing, due to both population growth and illegal importation of—often irreparable—electronic appliances from high-income countries. This is a huge problem in Kenya, as most e-waste ends up at illegal and open dumpsites, where it is often disposed of by open burning, placing individuals handling e-waste and entire communities at risk of exposure to released toxins (Lebbie et al., 2021). Additionally, even unburned electronic appliances contain harmful materials (e.g., lead, mercury, and zinc) that, through transportation via rain, pollute soil and water beyond dumpsites, compromising the health of natural ecosystems and harming the human body. To uncover the impact of institutional voids, the data collection consisted of semi-structured interviews, focus group discussions, and stakeholder meetings with entrepreneurial actors in Kenya's e-waste ecosystem. We analyzed these data by coding the institutional voids experienced by the actors and their implications for the circular ecosystem.

We contribute to research on circular ecosystems, in contexts characterized by institutional voids, in two ways. First, we uncover two key phases in the evolution of circular ecosystems affected by institutional voids, and we conceptualize, through a set of propositions, how institutional voids may affect each phase. Second, we propose a framework that illustrates the impact of formal institutional voids on the evolution of circular e-waste ecosystems and the realization of environmental benefits in necessity-driven contexts.

The paper is structured as follows. Section 2 discusses literature on institutional voids and circular ecosystems in LMICs. In Section 3, the methodology is presented, while Section 4 illustrates the findings of our empirical study. Lastly, Section 5 includes the discussion, contributions, practical implications, limitations, and future research directions.

2 | THEORETICAL BACKGROUND

2.1 | Entrepreneurship in and around institutional voids

Entrepreneurial activities are critically influenced by institutions (Mair & Marti, 2009). Institutions are the “rules of the game in a society” (North, 1990, p. 3), the “humanly devised constraints that structure political, economic, and social interaction” (North, 1991, p. 97). Scholars have distinguished formal and informal institutions, where the former represent “the written (or codified) rules or constraints” and the latter denote unwritten but socially accepted rules, norms, and beliefs that guide behaviors (Dau et al., 2022). Prior research has shown that, particularly in LMICs, formal institutions are often fragile and inefficient, engendering “institutional voids” (Saka-Helmhout et al., 2020). Stemming from the different types of institutions that exhibit a weakness or inefficiency, Khanna and Palepu (1997) identified five main types of voids: regulatory, contract enforcement, capital market, labor market, and product market voids (see Table 1 for a description of each void).

TABLE 1 Overview of the types of institutional voids (based on Khanna & Palepu, 1997; Palepu & Khanna, 1998; Parmigiani & Rivera-Santos, 2015).

Type of institutional void	Description
Labor market	Workers lack skills and training. The education system is inefficient and ineffective. The labor market is characterized by low flexibility.
Capital market	Investors lack (sufficient) information on the local capital market. Companies and individuals lack access to capital markets.
Product market	Buyers and sellers lack (sufficient) information on products, which limits their access and the assessment of their quality.
Regulatory	Regulations are lacking or ambiguous and there is high discretion in their application.
Contract enforcement	The enforcement of contracts, and of regulations in general, is absent or ineffective. Property rights are not respected.

Scholars have proposed two main perspectives on the influence of institutional voids on entrepreneurship in LMICs. On the one hand, institutional voids are conceptualized as constraints, which negatively affect the development and functioning of markets and entrepreneurs' participation in them (Mair & Marti, 2009; Saka-Helmhout et al., 2020; Sydow et al., 2022). For example, the absence of specialized human capital and of functioning financial markets, as well as an unreliable legal system, is critical barriers to enterprises' emergence and competitiveness in LMICs (Puffer et al., 2010; Saka-Helmhout et al., 2020). On the other hand, institutional voids may represent "opportunity spaces" (Mair & Marti, 2009) that entrepreneurs can leverage to establish their activities (Colovic & Schruoffenegger, 2022). Indeed, formal institutional voids do not result in an institutional vacuum; to facilitate and restrict certain practices, entrepreneurs can fill the voids by relying on informal institutional arrangements, such as social relationships, trust, customs, and shared norms (Dau et al., 2022; Mair & Marti, 2009; Puffer et al., 2010; Saka-Helmhout et al., 2020; Sydow et al., 2022; Webb et al., 2020). Such informal institutions can "provide access to critical resources, establish expectations for transactions, and ensure monitoring and enforcement of local activities" (Webb et al., 2020, p. 514). By offering a supportive institutional framework, informal institutions can drive the rise of an informal type of entrepreneurship, which consists of entrepreneurial practices that, despite being illegal, are perceived as legitimate and attractive in local contexts fraught with formal institutional voids (Sutter et al., 2013; Webb et al., 2020).

Despite offering divergent views of institutional voids' impact on entrepreneurship, the streams of literature adopting these two perspectives exhibit a set of common shortcomings. First, the focus of both bodies of work has largely been on how enterprises deal with institutional voids to establish themselves in a market (Webb et al., 2020). Although institutional voids are likely to also influence

the growth of entrepreneurial activities, these effects have largely been overlooked. Second, extant research has concentrated on entrepreneurs tackling social issues, such as poverty (e.g., Colovic & Schruoffenegger, 2022; Mair & Marti, 2009; Stephan et al., 2015). Yet, since environmental challenges, like water and soil pollution, critically affect LMICs as well (e.g., Betancourt Morales & Zarthia Sossa, 2020), investigating the role of institutional voids on entrepreneurial endeavors that address environmental issues is also relevant and likely to reveal novel insights. Third, scholars have focused on institutional voids' impact on individual enterprises (e.g., Mair & Marti, 2009; Puffer et al., 2010; Saka-Helmhout et al., 2020; Stephan et al., 2015; Sydow et al., 2022). Only very few studies, while still centered around single enterprises, hint at the creation of a network around them as a mechanism to address institutional voids. For example, Colovic and Schruoffenegger (2022) show that social enterprises tackle institutional voids also by developing and orchestrating a business network. Widening the focus to the ecosystem in which an entrepreneur is embedded is particularly important when considering complex environmental problems in LMICs, because they cannot be tackled by an entrepreneur alone. A case in point is the shift from a linear to a circular economy, which requires the involvement of multiple actors.

2.2 | Growth of circular ecosystems in low and middle-income countries

The notion of ecosystem has become increasingly important in the context of entrepreneurship for the circular economy (e.g., Asgari & Asgari, 2021; Henry et al., 2020; Zucchella & Previtali, 2019). In a circular economy, waste is "minimized by slowing, closing, and narrowing material and energy loops" (Geissdoerfer et al., 2017, p. 777), which is attained through sharing, refurbishment, remanufacturing, repair, and recycling (Korhonen et al., 2018). Realizing these circular activities often requires connecting different actors and value chains, for instance in settings where the waste or byproducts of one party constitute the input materials for another (Corvellec & Bramryd, 2012; Henry et al., 2020; Kanda et al., 2021; Pieroni et al., 2019). Given the importance of inter-organizational links, recent work has argued that the ecosystem is a more appropriate unit of analysis than the individual firm, for understanding value creation and value capture dynamics in the context of circularity (Asgari & Asgari, 2021; Kanda et al., 2021; Konietzko et al., 2020; Moggi & Dameri, 2021). The distinguishing feature of circular ecosystems, compared to other ecosystems, is that value (co-)creation is critically centered around keeping resources at their highest value (Ellen MacArthur Foundation, n.d.). This has relevant implications for actors' activities and interactions, as well as for the ecosystem's outcomes.

In particular, the environmental outcomes of a circular ecosystem critically hinge on the amount of resources that it recovers: the higher the amount of resources that are kept at their highest value, the higher the ecosystem's positive environmental impact. Therefore, building on prior research (e.g., Han et al., 2023; Sandberg & Hultberg, 2021), we argue that growth is a key avenue for a circular

ecosystem to scale its environmental impact, because it entails an increase in circular activities and, as a consequence, in the amount of resources recovered. Yet such growth is also complex, because circular ecosystems involve actors that are interdependent but tend to exhibit heterogeneous interests, needs and resources (Bertassini et al., 2021; Parida et al., 2019; Susur & Engwall, 2023; Tapaninaho & Heikkinen, 2022; Zucchella & Previtali, 2019). Given such complexity, a formal institutional environment that supports and steers actors to collaboratively engage in keeping resources at their highest value is paramount for the growth of a circular ecosystem (Fehrer et al., 2023; Konietzko et al., 2020; Susur & Engwall, 2023). Prior literature has, for example, highlighted the importance of regulations and public supportive measures (e.g., tax incentives), as well as formal agreements, certifications, and adequate market structures (e.g., Alonso-Almeida et al., 2020; Bimonte et al., 2022; Blomsma et al., 2023; Droege et al., 2023; Fehrer et al., 2023; Konietzko et al., 2020; Parida et al., 2019; Zucchella & Previtali, 2019). Yet this body of work has, thus far, largely focused on high-income economies; this is problematic, as findings might not be directly transferable to LMICs, for two main reasons.

First, as discussed above, LMICs are characterized by institutional voids; hence, circular ecosystems are confronted with a radically different institutional context compared to higher income countries. The limited studies addressing the impact of the institutional environment on circular practices in LMICs exhibit conflict insights, which reflect the divergent views of institutional voids illustrated above. For instance, Gall et al. (2020) found, in the context of informal waste-picking in Kenya, that the combination of material pre-sorting under informal conditions was helpful for the formal recycling system at later stages, i.e., subsequent industrial scale sorting. Other studies instead noted that the lack of formal governance hampers the effective participation of stakeholders in circular practices (Ddiba et al., 2020).

Second, while the members of circular ecosystems in high-income countries are usually unified by a common environmental purpose, in LMICs, circular activities are usually driven by economic need (Korsunova et al., 2022). Therefore, LMICs are often characterized by a “necessity-driven circular economy,” defined as “a set of locally embedded and interlinked formal and informal practices aimed at restoring and retaining the value of goods and materials for as long as possible, based on economic necessity and opportunities for income generation” (Korsunova et al., 2022, p. 1). Such unique motivation is likely to have implications for the impact that the institutional environment may have on the growth of circular ecosystems in LMICs.

3 | METHODOLOGY

3.1 | Research design and context

To study how the presence of institutional voids impacts the evolution of circular ecosystems in necessity-driven contexts, we adopted a single, qualitative case study design. This is a research design frequently applied to study phenomena that cannot be easily separated

from their local context, especially in the Global South (Crotty, 1998; Peltola et al., 2016). A single case study allows to examine a phenomenon in a level of detail that cannot be achieved through other methods (Ozcan et al., 2016). Understanding the impact of institutional voids on the ecosystem required a holistic and deep understanding of the local context, hence the choice for this research design.

As our study context, we selected the electronic appliances ecosystem (or e-waste ecosystem in short) in Kenya. The e-waste ecosystem in Kenya is an ideal case to investigate our research question for three key reasons. First, Kenya is characterized by formal institutional voids such as poor infrastructure, lack of skills, political and social instability, ineffective rule of law, and corruption (Sydow et al., 2022). Second, due to its rapid urbanization, population growth, economic development, and the vast—often illegal—import of second-hand e-waste, Kenya faces an increasing amount of e-waste (Maes & Preston-Whyte, 2022), which is not processed properly (Bimir, 2020). Third, despite the presence of severe institutional voids, entrepreneurial activity around e-waste in Kenya has grown steadily during the last 10 years (Lashitew et al., 2022; Sydow et al., 2022).

3.2 | Data collection

For our study, we draw on data from a large project commissioned by the United Nations Environmental Program (UNEP), in collaboration with the Kenyan Ministry of Environment and Forestry. UNEP commissioned a research team led by the first author of this study to conduct a detailed electronic appliances infrastructure analysis. This included four main components: a household characterization study based on 996 structured interviews; semi-structured interviews with different stakeholders of the circular ecosystem in four major cities, namely, Kisumu, Meru, Mombasa, and the capital, Nairobi, focus group discussions; and stakeholder meetings (see Table 2 for an overview of the data collected).

For this study, the main data sources were the semi-structured interviews and focus group discussions with the entrepreneurial actors (distributors, repairers, remanufacturers, and recyclers) and stakeholder meetings, as they allowed us to understand opportunities and barriers for the actor groups participating in the entrepreneurial ecosystem, their structure of value creation and capture, and their interaction. The household data served to gather background information that allowed us to gain an understanding of the context in which the ecosystem was embedded.

The research team led by the first author was in charge of designing the data collection instruments and conducting the interviews and focus group discussions with the entrepreneurial actors. The second and third authors were only involved in the data analysis. All the structured interviews with households¹ were supported by a local NGO.

¹The structured interviews with households included survey-like questions on electronic appliance ownership, e-waste generation, collection, and treatment, as well as awareness of policy and circular economy concepts. Each of the structured interviews with households was digitalized and transcribed. The responses were collected in an excel sheet.

TABLE 2 Data collection per actor, format used and number of data points.

Actor groups	Format used	Number of interviews
Households	Structured interviews	966
Government departments	Interviews	6
NGOs/CSOs	Interviews	8
Distributors	Interviews	28
Repairers and remanufacturers	Interviews	48
Recyclers	Interviews	4
Informal waste pickers at open dump sites	Interview	3
Focus group discussions with entrepreneurs active in circular e-waste ecosystem (e.g., distributors, repairers, and recyclers)	Focus group discussion	2
Stakeholder meetings with 20+ private and public parties active in circular e-waste ecosystem (e.g., distributors, repairers, consultants, governments, and NGOs)	Stakeholder meeting	3
Total		1,098

This was necessary to speak to people in the local language, and to increase the willingness to participate, given their embeddedness in the local context.

The semi-structured interviews with the entrepreneurial actors started with basic information about the focal actor, their size, and focus area, followed by more detailed questions about their activities (e.g., for repairers, this included “what electronic appliances do you repair and in which quantities?” and “why can't you repair certain parts?”) and view on the circular e-waste ecosystem (e.g., “what do you see as the responsibility of the following actors [recyclers, producers, distributors, repairers, governments] in relation to electronic appliances management?”). The interview would continue with questions about the actor's business model (e.g., for repairers this included “how much revenue do you generate from repair?”) and about regulations and policies followed (e.g., “which policies/legal instruments do you know that apply to managing e-waste in Kenya?”). The last and most elaborate part of the interview focused on experienced barriers and opportunities, with questions such as “which barriers prevent you from growing your business?”. All interviews were conducted at the place of business of the interviewee, which helped to gain a more detailed understanding of the interviewee's business, and their challenges.

To understand the effect of each actor group on another, and triangulate informants' opinion, focus group discussions with entrepreneurs directly active in the circular e-waste ecosystem (e.g., distributors, repairers, remanufacturers, and recyclers) were held. During the focus group discussions, participants discussed the barriers and opportunities experienced for the growth of their business, as

well as the (lack of an) enabling environment. Lastly, to further validate and cross-compare the results, the research team organized three stakeholder meetings with private and public parties active in the circular e-waste ecosystem. These meetings served the purpose to present, verify, and adapt intermediate results, if needed.

3.3 | Data analysis

Our analysis proceeded in three steps, linking our empirical observations to existing theory on both institutional voids and ecosystems.

Step I: Identifying institutional voids

In the first step, we sorted the responses in an Excel file, per actor group. We then carefully read these responses and coded those that related to institutional voids. In practical terms, this means that we coded the data deductively, using the classification of institutional voids shown in Table 1. For example, interviewee responses like “lack of money from the government” and “unavailability of finance resources to procure relevant equipment” were coded as “lack of access to finance” and thematically grouped under the institutional void “Capital Market.” Where in doubt, we discussed in the team of authors how to group codes. Eventually, this allowed us to make a description of each void, representing a synthesis of the different responses. For instance, for “lack of access to finance,” the description was “Access to finance to start up or expand a business in e-waste is difficult, especially for smaller entrepreneurs such as repairers, remanufacturers and recyclers.”

Step II: Linking institutional voids to opportunities and barriers

In a next step, we coded inductively for the opportunities and barriers experienced by each actor group and then linked these to the institutional voids identified in Step I. For instance, when repairers reported barriers to access suitable equipment, we coded this as “resources are missing because actors lack capital.” We then grouped these barriers and linked them to the institutional void “access to finance.” Ultimately, we synthesized the barriers per institutional void by combining the actors' perspectives. For instance, the synthesized description of the barrier corresponding to the void “access to finance” became “lack of access to capital creates a key reason why electronic appliances cannot always be repaired: too costly spare parts, no access to more advanced tools and equipment.” A similar analysis was done for the opportunities. The overview of barriers and opportunities caused by each void allowed us to have a stable view of how each institutional void affected the evolution of the circular e-waste ecosystem in Kenya.

Step III: Finding patterns and developing propositions

In the final step, we set out to critically review and cross-compare the barriers and opportunities named for patterns; for instance, we

examined how often a certain barrier was named by a certain actor group or if certain voids affected some actors more than others. We also analyzed the statements themselves again; for instance, we tried to check whether opportunities or barriers related more to “value creation” or “value capture.” However, it became clear that this seemed a too static perspective to differentiate the impact of the institutional voids on the entrepreneurial activities. The most salient pattern becoming apparent in the data was that institutional voids not only affected the establishment of entrepreneurial activities as previous research has shown but also the potential to grow the impact of the ecosystem. While the emergence of the ecosystems dates back roughly 15 years and our study was not aimed at gathering longitudinal data, it was clear that some statements were more concerned with causes and the past while others were more concerned with effects and the present or future. Thus, we distinguished between two phases in which institutional voids impact the evolution of the ecosystem differently: the emergence phase and the growth phase. We then worked to disentangle the order of occurrence of these effects and how the interrelations between barriers caused by institutional voids influenced the potential to grow the circular e-waste ecosystem. As a result, we were able to develop a set of propositions on the influence that institutional voids have during these two phases and suggest a process model to visualize our findings.

4 | FINDINGS

Although the amount of electronic appliances in Kenya is still low compared to high-income countries (~30% of households own electronic appliances), this number is increasing rapidly due to population and GDP growth, urbanization, and widespread access to electricity. Refrigerators are the most owned electronic appliance in Kenya, with roughly 20% of the population owning one (Bastein et al., 2021). Other frequently purchased electronic appliances include microwaves, electric fans, electric heating appliances, electric cooking equipment, washing machines, and dishwashers. Households generally consider their electronic appliances as valuable, as the appliance's cost is often high compared to the household's income. The circular e-waste ecosystem in Kenya is characterized by the involvement of multiple actors who interact with each other (see Figure 1).

The material flows within the circular e-waste ecosystem follow a rather straightforward path, where electronic appliances are bought, usually second hand, from shops and markets. When an electronic appliance breaks, it is usually sent to a repairer. If the appliance is beyond repair, it will either be discarded at (illegal) dumpsites, collected by a waste picker, sold to a remanufacturer or collected by recyclers. While some waste pickers collect the appliances directly from households, most scavenge dumpsites. Waste pickers then sell the electronics to remanufacturers for spare parts, sell to recyclers, or try to recover valuable materials, such as copper, themselves. Remanufacturers receive their materials from households,

repairers, and collectors and sometimes trade spare parts among each other. Appliances that are beyond repair will be dumped or brought to recyclers. Recyclers extract useful materials and sell them to the processing industry; sometimes, they export parts that cannot be recycled.

Although there is a circular e-waste ecosystem in place which handles repair, remanufacturing, and recycling, these actor groups are rather small and cannot nearly process all the e-waste available in Kenya. Overall, most e-waste beyond repair is dumped at dumpsites, without any possibility to be recovered. To prevent negative environmental consequences of e-waste at dumpsites, the ecosystem needs to grow.

In the following sections, we first explain the institutional voids affecting the circular e-waste ecosystem in its emergence and growth phases, and then, we introduce a phase model, to theorize the impact of institutional voids on a circular e-waste ecosystem.

4.1 | Institutional voids and the emergence of the circular e-waste ecosystem

Our analysis shows that three formal institutional voids have strongly contributed to the emergence of a circular e-waste ecosystem.

Regulatory voids. There is no government-led e-waste infrastructure in place, making it difficult for households to dispose of electronic devices safely. This has resulted in illegal dumping of e-waste, harming the environment. However, this gap has created opportunities for the private and informal sectors to step in. The abundance of discarded electronics and the lack of a formal disposal system have given rise to remanufacturers, recyclers, and various collection methods like collection points and door-to-door services.

Contract enforcement voids. Enforcement of the few existing e-waste regulations is low, due to budgetary issues and lack of supporting statutory instruments to existing regulations. Especially, the lack of enforcement of the EMCA 2015 Act, which prohibits the handling, transportation, and disposal of (e-)waste without a valid license, enables small and informal e-waste actors to become active in the sector, without risking a fine. Additionally, plenty of second-hand electronics are imported illegally from Europe, despite regulations prohibiting this. This has boosted electronic appliance access in Kenya across all income levels. Due to the varying quality of these used items, there is a substantial demand for repairs. This has led to the growth of repair businesses. If a repair is not feasible, households seek to salvage some value by selling them to informal collectors or remanufacturers for spare parts.

Interaction effects. These two interconnected voids have created opportunities for both private and informal actor groups to become active in the e-waste ecosystem, to partly fill the formal institutional voids. *Repairers* are readily available in all urban low- and middle-income areas examined in this study, due to the penetration of illegally imported second-hand appliances, and create value to households by offering repair services close to home. Most of the repairers

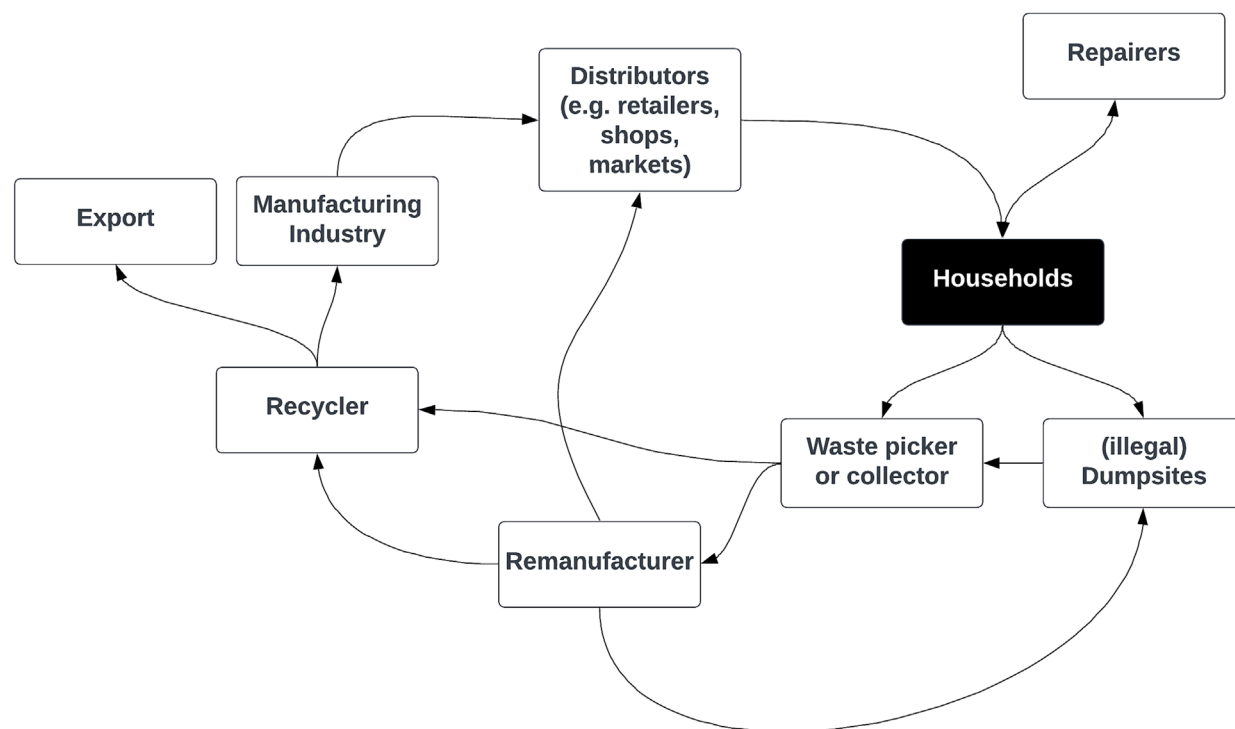


FIGURE 1 Visualization of the material flow of electronic appliances in the circular e-waste ecosystem in Kenya.

are informal small enterprises consisting of one to five people. *Remanufacturers* refurbish and remanufacture electronic appliances out of discarded electronics and spare parts. Since there is no public collection framework, remanufacturers often buy broken electronic appliances from informal waste pickers. *Recyclers* try to recover valuable materials in the electronic appliance. Both formal and informal recycling activities have emerged throughout Kenya. Formal recycling is mainly located in Nairobi with few actors active. Informal recycling is more common, with waste pickers disassembling electronics to collect valuable materials such as copper.

Private and informal actors, such as remanufacturers and recyclers, have partly filled the lack of a public waste management framework, by setting up collection points, where individuals or companies can deposit their electronic appliances. Some even set up collection routes in fenced neighborhoods, where they would announce a collection day and offer *households* home-pickups of their electronic appliances. Some repairers in low- and middle-income neighborhoods offer home pickup and drop-off for reparation jobs, therefore diversifying the services they offer. Access to spare parts is increased by repairers, remanufacturers (mostly informal), and sometimes even *distributors* and recyclers, trading among each other in the absence of any formal structure that grants access to spare parts. Although these voids opened up vast opportunities for informal e-waste workers, repairers, and recyclers to collect and dismantle e-waste for parts, it also has severe negative effects on human health of, especially, informal e-waste workers and communities neighboring

dumpsites, since informal dismantling of e-waste often involves open burning.

Overall, the regulatory and contract enforcement formal institutional voids have created opportunity spaces for both the informal and private sector to become active in circular e-waste practices, which has contributed to the emergence of the circular e-waste ecosystem, as summarized in Table 3.

Based on these findings, we propose the following propositions:

P1. In LMICs, formal institutional voids on circular e-waste practices are likely to trigger the emergence of an entrepreneurial ecosystem around e-waste.

P1b: In LMICs, *regulatory voids* on circular e-waste practices (e.g., lack of formal infrastructure) are likely to be partly filled by (i) private and informal entrepreneurs, who collect electronic appliances and provide them to other actors for repair, remanufacturing and recycling, and (ii) households who view their old electronic appliances as valuable and actively seek for opportunities to repair or sell them.

P1c: In LMICs, *contract enforcement voids* on e-waste management are likely to enable informal entrepreneurs to handle e-waste without a valid license, and entry of second-hand appliances are likely to result in large illegal e-waste import leading to an informal second-hand market that facilitates circular e-waste practices.

**TABLE 3** Overview of formal institutional voids and their contribution to the emergence of the circular e-waste ecosystem in Kenya.

Category	Institutional void	Effect on the emergence of the ecosystem
Regulatory	No public framework for e-waste awareness, collection, treatment, and disposal. Leading to an absence of a formal government-initiated e-waste collection infrastructure	- Enables repairers to experiment with their business model and offer different services like repairs at home and home pickup - Formal and informal e-waste actors set up collection points for individuals and companies to deposit their e-waste. However, in many regions this is nonexistent, offering potential for informal waste pickers to move around informal areas and dumpsites to collect electronic appliances, dismantle and remove valuable materials for sale - Recyclers, repairers and sometimes distributors, work with the informal sector for door-to-door e-waste collection or “waste pickers” to collect e-waste from dumpsites to supply them with materials to recycle, remanufacture and spare parts - Households see their electronic appliances as valuable, and in the absence of a formal collection system will actively look for ways to retain value of their electronic appliances. Thus, households will actively look where to repair or sell their old electronic appliances to
Contract enforcement	Enforcement of few existing e-waste regulations is low due to budgetary issues. Many regulations do not yet have supporting statutory instruments	No enforcement of EMCA 2015 Act which prohibits handling, transportation and disposal of (e-)waste without a valid license, which enables repairers, remanufacturers, recyclers and informal waste workers to handle e-waste
	Vast illegal and undocumented entry of e-waste into the country, despite prohibiting regulations	Large market for second-hand e-waste of varying quality, giving opportunities to repairers and remanufacturers to repair and resell second-hand products

4.2 | Institutional voids and the growth of the circular e-waste ecosystem

Our findings show that institutional voids have an impact on the circular e-waste ecosystem after its emergence, by influencing its potential to grow. Understanding how institutional voids continue to impact the circular e-waste ecosystem after its creation is crucial since, in the absence of a public framework for e-waste collection, treatment, and disposal, private and informal actors are the main drivers of the ecosystem. Furthermore, growing the ecosystem's impact (reduction of electronic appliances-related waste, by growing e-waste actors' number and size), is essential to minimize the negative environmental consequences of e-waste mismanagement.

Labor market voids. The absence of formal institutions for training and knowledge sharing in circular e-waste practices has restricted the development of advanced repair and remanufacturing skills for electronic appliances. Repairers and remanufacturers have typically acquired their expertise through self-learning or mentorship from more experienced peers but now report that “training should be conducted to equip people on new skills.” As electronic devices become increasingly complex due to advancements in digital technology, there is a growing demand for skill enhancement and capacity building to tackle intricate repair and remanufacturing tasks.

Capital market voids. It is challenging for all actors in the e-waste sector to access finances to start or expand a business. Financial

institutes are usually unwilling to support informal, usually small, enterprises. This limits growth of repair, remanufacturing, and recycling businesses, since these cannot acquire the tools and equipment needed to handle more advanced electronics and lack the funds to buy new parts. Even for formal actors, there exists barriers in access to finance. One recycler reported that “the interest of loans [at banks] is too high.”

Product market voids. Lack of adequate data on electronic appliances makes it difficult for formal businesses to make a business plan, growth strategy or acquire capital from financial institutes, since they cannot provide reliable details on expected turnovers. Moreover, the lack of standards, spare parts, guidelines, and certificates on second-hand, repaired, or remanufactured electronic appliances leads to a lack of customer trust, decreasing customers' willingness to pay. This impacts the value capture potential for repairers, remanufacturers, and distributors of second-hand appliances. One repairer stated that “most of the parts [that are needed] for repair are not available, making [repairing] difficult and expensive” while a distributor argued that “[electronic appliance producers] should come up with appliances with similar technology to enhance easy repair.” The difficulty to access spare parts has partly been filled by the actors themselves, who sell and trade them among each other and collaborate with waste pickers.

Regulatory voids. Two types of regulatory voids influence the growth of the circular e-waste ecosystem. The first one concerns the lack of

financial support, such as subsidies, tax reductions, Extended Producer Responsibility² (EPR) regulations, and other financial benefits. All actor groups report challenges regarding long-term financial sustainability. A remanufacturer stated that the “lack of enough support and money from the government” was the most important reason for his struggle with financial sustainability. Repairers and remanufacturers could benefit from tax reductions on tools and equipment and from access to finance, while recyclers could benefit from subsidies and EPR schemes. Formal recyclers reported that the greatest challenge in achieving financial sustainability within the current institutional framework is the high costs of recycling and the low economic value of recovered materials. Although Kenya adopted EPR regulations in 2021, their operationalization has been significantly delayed. The implementation of the EPR regulations would allow recyclers and remanufacturers to access additional revenue streams. The second regulatory void, which affects nearly all actors in the ecosystem, is the lack of institutional arrangements at any government level (national, district, and city) for e-waste awareness, collection, treatment, and disposal. As a result, a formal e-waste collection infrastructure is largely nonexistent. Hence, households generally dispose of their electronic appliances with little value (e.g., electrical fans and heaters) at illegal dumpsites, while they store irreparable appliances with high value in the house, in the hope to recover some of the value at a later time. For example, refrigerators become closets or coolers, and microwaves, washing machines, or dishwashers become cabinets. These behaviors limit the amount of broken electronic appliances in circulation, which makes it highly difficult for remanufacturers and recyclers to get sufficient volumes, limiting their value capture potential and preventing benefits from economies of scale.

Contract enforcement voids. Lack of enforcement of the few existing e-waste regulations increases the amount of illegal dumping. Although households are required by law to guarantee a safe and environmentally friendly disposal of e-waste, this is not taught nor enforced, and there is no infrastructure available for households to easily comply with these regulations. A recycler stated that “they don’t involve companies that are dealing with waste when making laws, which end up not working.” The lack of enforcement that prevents practices such as open burning of electronic appliances to access valuable materials negatively impacts human health and the potential business case for collection points. Informal e-waste workers might rather dismantle appliances themselves, than sell these to collection points, exposing themselves to severe health risks and environmental pollution.

Interaction effects. There are some interaction effects present between void categories, which amplify the effects of institutional voids on the growth of the ecosystem. First, labor, capital, and product market voids reinforce each other, limiting the amount of electronic appliances repaired and remanufactured. Repairers, remanufacturers, and recyclers state that the inability to repair an electronic

appliance is more often the result of institutional voids, than of the appliance being beyond repair. Repairers report that they are often able to identify the problem, know it can be fixed, but lack the skills to fix it (*labor marked void*), or the manufacturer guidelines to perform a repair (*product marked void*) or lack the funds to purchase spare parts or advanced equipment to perform complex repairs (*capital market void*). Since the complexity of electronic appliances is increasing, second-hand appliances are getting more difficult to repair, remanufacture, or recycle without advanced skills, knowledge, and tools. Second, financial sustainability for recyclers is difficult to obtain due to interaction of three institutional voids. The limited collection of electronic appliances, resulting from the absence of a formal collection system (*regulatory void*), hinders the potential for economies of scale. Simultaneously, the labor-intensive process of separating electronic appliances into valuable materials is exacerbated by the absence of skills, guidelines, and advanced automated equipment (*labor market void*). Furthermore, the absence of EPR regulations and financial incentives (*regulatory void*) compounds the already existing challenges of achieving financial sustainability further. Third, some voids might pose a barrier for growth to one actor, while creating opportunities for another. The vast entry of illegal second-hand e-waste (*contract enforcement void*) of varying quality offers big opportunities for repairers to repair broken appliances but negatively affects the business model of distributors selling new products. In turn, it opens up opportunities for distributors to also sell second-hand appliances and to experiment with their business model by offering guarantees on second-hand products for a fee. However, in combination with the lack of guidelines and certifications (*product marked void*), there is a decreased trust among customers to buy locally remanufactured second-hand appliances, which then leads to barriers to growth. Furthermore, the high amount of illegal e-waste (*contract enforcement void*) in combination with the lack of an enforced public framework for e-waste awareness, collection, treatment, and disposal (*regulatory void*) increases the number of people exposed to e-waste related health risks and increases environmental pollution.

Overall, the labor, capital and product market, regulatory, and contract enforcement voids have hindered both the value creation and value capture potential of various actor groups, which has negatively affected the potential for growth of the circular e-waste ecosystem, as summarized in Table 4.

Based on the findings, we propose the following:

P2. In LMICs, formal institutional voids are likely to hinder the growth of circular e-waste ecosystems.

P2a: In LMICs, *labor market voids* (e.g., lack of capacity building or knowledge sharing on circular e-waste practices) are likely to limit the amount of electronic appliances repaired and remanufactured.

P2b: In LMICs, *capital market voids* are likely to hinder the growth of e-waste entrepreneurs, because they limit the accessibility of more advanced tools, machines, and spare parts needed to repair electronic appliances.

²Extended Producer Responsibility (EPR) is a policy approach wherein producers are given a significant responsibility, either financial or physical, for the treatment, recycling, or disposal of post-consumer products.

TABLE 4 Overview of formal institutional voids and their effect on the growth of the circular e-waste ecosystem in Kenya.

Category	Institutional void	Effect on the growth of the ecosystem
Labor market	No formal institutes focused on capacity building or knowledge sharing regarding circular e-waste practices	Limits the knowledge and skills needed to conduct more advanced repairs
Capital market	Difficulty in access to finance to start up or expand a business. In particular for smaller enterprises	Limits ability to acquire spare parts, advanced tools and equipment
Product market	Inadequate data on e-waste generation rates, treatment rates and methods Lack of standard specifications, spare parts, certificates and quality guidelines for repaired and remanufactured electronic appliances	Leads to difficulty in developing a data-driven business plan, which increases the difficulty to plan or acquire finance - Leads to lack of trust from customers, thus a reluctance to buy second-hand appliances - Leads to issues regarding absence of guidelines from manufacturers for repair and remanufacture activities as well as difficulty to access spare parts. Partly filled by repair and remanufacture shops who trade, buy and sell spare parts among themselves in absence of any formal platform or formal structure
Regulatory	Insufficient financial support or regulatory framework to stimulate circular e-waste practices such as subsidy, EPR or tax reductions No public framework for e-waste awareness, collection, treatment and disposal. Leading to an absence of a formal government-initiated e-waste collection infrastructure	Limits the financial sustainability of all actors - Leads to the disposal of large amounts of electronic appliances at illegal dumpsites, which is harmful to the environment and to human health - Limits the potential for actors such as recyclers to access sufficient volumes to profit from economies of scale - Prevents households' electronic appliances from entering the circular e-waste ecosystem, since households see their electronic appliances as valuable and are hardly ever willing to just dispose of it - Leads to severe health risks for informal waste pickers collecting and treating e-waste
Contract enforcement	Enforcement of few existing e-waste regulations is low due to budgetary issues. Many regulations do not yet have supporting statutory instruments	Regulations on mandatory safe disposal of e-waste by households is not taught nor enforced, leading to illegal waste dumping

P2c: In LMICs, *product market voids* (e.g., inadequate data and standard specifications on e-waste) are likely to hinder the growth of a local market for repaired and remanufactured electronic appliances.

P2d: In LMICs, *regulatory voids*, which consist of the absence of (i) public financial support for circular e-waste practices, are likely to hamper the financial viability of e-waste recycling and remanufacturing; (ii) public framework for e-waste collection is likely to limit access to spare parts; hinders economies of scale in repair, remanufacturing, and recycling; and stimulate illegal e-waste dumping; and (iii) public framework for e-waste awareness and treatment is likely to limit the amount of electronic appliances that enter the ecosystem, since households are not willing to easily part with their appliances, even when beyond repair in the hope of future value recovery.

P2e: In LMICs, *contract enforcement voids* are likely to limit the willingness of households to invest in the safe disposal of e-waste.

P2f: In LMICs, the interactions between labor market, capital market, product market, regulatory, and contract enforcement

voids amplify their individual effects on the circular ecosystem, hindering its growth.

4.3 | Theorizing the impact of institutional voids on the circular e-waste ecosystem: A phase model

The presence of institutional voids has enabled entrepreneurial opportunities regarding the collection, treatment (i.e., repair, remanufacture, and recycle), and disposal of electronic appliances in Kenya. This has led to the emergence of a small but circular entrepreneurial ecosystem. However, as illustrated in Section 4.2, these institutional voids also hinder the growth of that ecosystem, and, as a result, the environmental benefits the ecosystem can realize.

Most actors are driven by economic necessity, as their main incentive to participate in the e-waste sector is to make a living. Only some actors, often supported by NGOs, join the ecosystem due to (more) altruistic motivations. Regardless, the existence of the circular e-waste ecosystem has elicited (unintended) environmental benefits, since the amount of e-waste that ends up at illegal dumpsites is

reduced through the repairing, remanufacturing, and recycling of electronic appliances.

These environmental benefits have to be maintained and preferably increased. However, Section 4.2 shows that the persistent barriers stemming from formal institutional voids have negatively impacted the opportunity for growth of entrepreneurs within the circular e-waste ecosystem. This in turn marginalises the environmental benefits that would have been obtained by the growth of the circular e-waste ecosystem without institutional voids. For example, the product market void of “vast illegal and undocumented entry of e-waste into the country” has created a large market for second-hand e-waste of varying quality, giving opportunities to repairers and remanufacturers to repair and resell second-hand products, contributing to the emergence of the ecosystem. Instead, other product market voids such as “the lack of standard specifications, certificates and quality guidelines for repaired and remanufactured electronic appliances” have led to a lack of trust from customers, resulting in their reluctance to buy second-hand appliances, which affects the sales of remanufacturers and thus the growth of this actor group, thus negatively affecting the circular e-waste ecosystem.

We developed a framework to explain how the effects of institutional voids, during the various phases of evolution of the ecosystem, may shape the extent to which the ecosystem can sustain environmental benefits, as seen in Figure 2. First, the presence of formal institutional voids (in gray) has opened up entrepreneurial opportunities leading to the emergence of a circular e-waste ecosystem (left cycle), which in turn has led to unintended environmental benefits (straight line). The continued presence of formal institutional voids (in gray) has limited the growth of entrepreneurs,

thereby limiting the growth of the circular e-waste ecosystem (right cycle) and marginalizing the unintended environmental benefits (dotted line).

Based on these findings, we propose the following:

P3. In LMICs, participation in circular e-waste ecosystems is likely to be necessity-driven: actors are driven by economic motives and shift to the most profitable entrepreneurial opportunity.

P3a. In LMICs, necessity-driven circular e-waste ecosystems are likely to lead to environmental benefits, such as reduction of e-waste in the environment.

P3b. In LMICs, environmental benefits might be marginalized if the growth of the circular e-waste ecosystem is hindered by the continued presence of institutional voids.

5 | DISCUSSION

We set out to explore how the presence of institutional voids impacts the evolution of a circular ecosystem in necessity-driven contexts. Necessity-driven contexts differ from other contexts, as they are often characterized by a lack of formal institutions in capital, labor, and product markets, as well as regulatory environments (Saka-Helmhout et al., 2020). These voids allow for the emergence of entrepreneurial activities that are illegal yet remain legitimate to large groups in a society (Webb et al., 2020). This study shows, through three sets of propositions, that (1) formal institutional voids on circular e-waste practices are likely to trigger the emergence of a necessity-

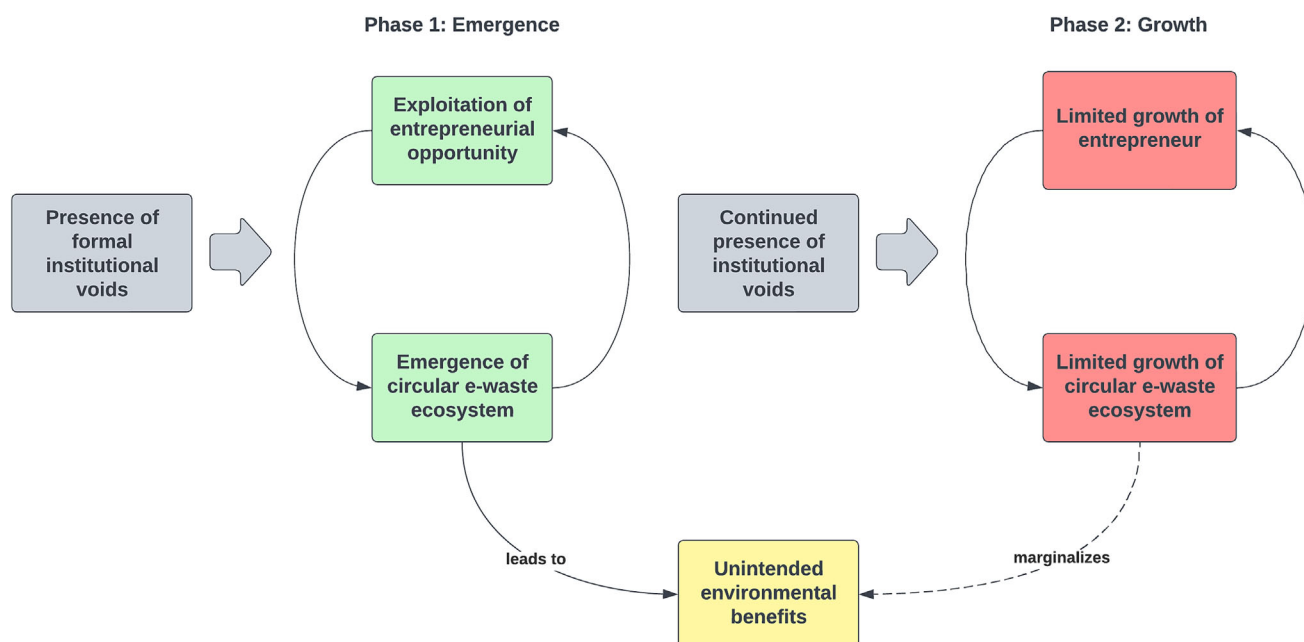


FIGURE 2 Framework on the relation between institutional voids, the emergence and growth of the circular ecosystem in Kenya, and the potential marginalization of its environmental benefits.

driven circular e-waste ecosystem, (2) formal institutional voids are likely to hinder the growth of such a circular e-waste ecosystem, and (3) unintended environmental benefits that are likely to emerge in necessity-driven circular e-waste ecosystems might be marginalized if growth is hindered by the continued presence of institutional voids.

5.1 | Theoretical contributions

Our study offers three contributions to the literature on institutional voids and circular ecosystems.

First, studies on institutional voids tend to either perceive institutional voids as negatively affecting entrepreneurs (Saka-Helmhout et al., 2020; Sydow et al., 2022) or as opportunity spaces that entrepreneurs can leverage to establish their activities (Colovic & Schruoffenegger, 2022). However, our results have shown that the way institutional voids affect entrepreneurs differs depending on the evolution of the ecosystem. We distinguish two key phases in the evolution of a circular ecosystem (emergence vs. growth), and the propositions we developed unpack the impact that the different types of institutional voids have on the ecosystem in each phase. Importantly, our case supports that formal institutional voids have an ambiguous impact; while they are likely to support the emergence of a necessity-driven circular e-waste ecosystem, they are also likely to limit its growth. This has a number of implications for research: first and foremost, it implies that studies need to differentiate between phases in the evolution of circular ecosystems. Our findings strongly support that a “black-or-white” dichotomy, in which formal institutional voids are either conceptualized as opening opportunity spaces for entrepreneurs (Colovic & Schruoffenegger, 2022; Mair & Marti, 2009) or as hindering them (Puffer et al., 2010; Saka-Helmhout et al., 2020; Sydow et al., 2022), is too simplistic in LMICs.

Second, studies on institutional voids have concentrated on entrepreneurs tackling social issues such as poverty (e.g., Colovic & Schruoffenegger, 2022; Stephan et al., 2015), while environmental challenges critically affect LMICs as well (e.g., Betancourt Morales & Zarthia Sossa, 2020). In response to this gap, we have proposed a framework that shows the relationship between the evolution of institutional voids' effects and the potential marginalization of environmental benefits in necessity-driven circular e-waste ecosystems. This is a particularly interesting point to consider for scholars interested in the (potential) impact of circular ecosystems (e.g., Aarikka-Stenroos et al., 2021). In circular ecosystems that emerged out of economic necessity, environmental benefits occur “accidentally”—at least from the perspective of the individual entrepreneurs in the ecosystem. The principal motivation of these entrepreneurs is the realization of economic benefits, not of circularity. This might make the ecosystem more fragile, because, if barriers hindering the growth of the individual entrepreneur are not addressed (in the form of reducing institutional voids), these entrepreneurs might move to pursue other activities.

Third, scholars have focused on institutional voids' impact on individual enterprises (e.g., Mair & Marti, 2009; Puffer et al., 2010; Saka-Helmhout et al., 2020; Stephan et al., 2015; Sydow et al., 2022), while

realizing circular activities requires connecting different actors and value chains (Kanda et al., 2021). We respond to researchers that called for adopting an ecosystem perspective, rather than an actor perspective, in both the literature on circularity (Corvellec & Bramryd, 2012; Kanda et al., 2021; Pieroni et al., 2019) and the body of work on institutional voids (Cobben et al., 2022; Colovic & Schruoffenegger, 2022). Our study does not only offer an indication for other researchers on how such research can be designed, but it also showcases the value of taking an ecosystem perspective when studying the effects of institutional voids: an institutional void can influence one actor differently than another and thus have a different impact on the ecosystem depending on interactions between actors. Furthermore, combinations of institutional voids also influence actor groups differently.

5.2 | Practical implications

Our findings offer a number of practical implications that matter for circular ecosystem actors.

In the presence of institutional voids, policymakers must consider the interplay between these voids and their proposed interventions. Circular waste management, which encourages private and informal actors to retain value, is gaining in popularity as a solution to the waste problem in LMICs, due to resource constraints hampering public waste collection and treatment (e.g., Ferronato & Torretta, 2019; Gall et al., 2020). Our study highlights that policymakers cannot simply adopt strategies used in developed economies, because institutional voids create a fundamentally different starting point. When introducing public frameworks for e-waste management, policymakers must understand how the voids have been filled without such frameworks. This is crucial because there may be adverse effects: while institutional voids can hinder entrepreneurs, filling them might also have (partial) negative impacts. For example, enforcing regulations requiring a valid license for handling, transporting, and disposing of e-waste could protect informal workers (e.g., informal waste pickers, repairers, remanufacturers, and recyclers) from health risks but could also jeopardize their livelihoods. Therefore, policymakers need to thoroughly assess the ecosystem's status, recognize its evolving phases, and understand how institutional voids affect different actors in the system at various stages, as demonstrated in our paper.

The study has also relevant implications for entrepreneurs in LMICs, who want to engage in the recovery of e-waste. First, it suggests how entrepreneurs could leverage the different voids they may experience in their local environment to engage in circular activities. Second, it highlights the importance, for an entrepreneur, of seeing their circular activities in the context of a wider circular ecosystem and of interacting with other actors for financial and environmental value. Third, by illuminating how the growth of their activities may be hindered by institutional voids, it indicates which aspects (groups of) entrepreneurs should lobby for improvements.

Beyond policymakers and entrepreneurs, our study holds relevance for donors and NGOs active in the e-waste ecosystem. It

shows which institutional voids pose barriers to various actor groups during growth. This is helpful for donors and NGOs who seek to develop more targeted interventions and want to gain a better understanding of the interaction between different institutional voids.

5.3 | Limitations and future research

Our study has a set of limitations, which suggest promising avenues for future research.

First, while our paper examines a circular ecosystem's growth, it does not trace its ongoing growth. The period we were able to observe is limited but already indicated that differentiation between phases is necessary. Thus, the impact of the institutional context is not static but dynamic, and there might be more phases than those that we observed. Therefore, future research could address this gap by conducting a processual, longitudinal study over multiple decades, of circular ecosystems in LMICs.

Second, we observed a necessity-driven e-waste ecosystem, where the main incentive of its actors was driven by economic value capture potential, rather than environmental value creation. We did not dive deeper into the considerations for actors to focus on more than just economic value creation, while they might have been present. A better understanding of the value creation and value capture logics for the single actor would be key for understanding the (limits to) growth of the environmental benefits the circular ecosystem realizes. For future studies in LMICs exhibiting institutional voids, it might therefore be particularly insightful to tap into the tension between the economic, environmental, and social value that actors can and want to realize. Such findings could then be compared to findings on circular ecosystems in contexts without institutional voids (Kanda et al., 2021; Konietzko et al., 2020).

Third, we chose to focus on one country as a single case study that implies some limitations. Although Kenya was chosen because it experiences vast amounts of illegal entry of e-waste that also other LMICs in Africa experience, future research could verify our findings in other African countries. The three propositions we have developed offer a starting point for investigation in different empirical settings. While future studies need to consider that these propositions emerged in the specific context of circular e-waste management in Kenya, we argue that they might plausibly apply also to other geographic and circular contexts. Specifically, they might hold for countries with similar e-waste characteristics such as Ghana and Nigeria but might be different for African countries that do not experience vast amounts of illegal entrance or have limited electronic appliance penetration among households. Additionally, it must be noted that our study relies on self-reported data. While we did include a variety of actors and took care to triangulate between actors and data sources, there is a chance of respondent bias and that informants may have exaggerated certain problems or downplayed the degree to which they engage in socially unacceptable or illegal behavior (e.g., dumping waste). However, overall, we are confident that the

entirety of the data we collected adequately captures the dynamics we aimed to investigate in this study.

Lastly, it is important to emphasize that our research did not measure the actual environmental performance of the circular ecosystem along its evolution nor place a strong focus on the social consequences of circular ecosystem's evolution. A valuable research avenue would consist of examining the relationship between institutional voids and actual waste reduction along the development of the ecosystem as well as its influence on human rights and health risks, to assess which kind(s) of void has a stronger ecological or social impact over time.

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