

'Igbo-Made' Ingenuity and Frugal Bricolage: Circular Economy Adaptations to Institutional Failures

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ABSTRACT:

Dominant eco-innovation and circular economy frameworks are largely grounded in the institutional conditions of advanced economies, where firms benefit from reliable infrastructure, accessible finance, technological capabilities and predictable regulatory systems. This study examines how environmentally beneficial innovation emerges under contrasting conditions of institutional fragility, infrastructural instability and persistent resource scarcity. Drawing on organisational bricolage theory, the study investigates the adaptive practices associated with “Igbo-made” ingenuity among Nigerian small and medium-sized enterprises operating across manufacturing, recycling, logistics and agri-processing sectors. A qualitative research design informed by critical realism and pragmatism was adopted. Semi-structured interviews were conducted with ten SME owner-managers, and the data were analysed using the Gioia methodology alongside abductive and retroductive reasoning. The findings identify three interconnected forms of adaptation: material bricolage through waste-to-value practices, mechanical bricolage through informal engineering and technical modification, and infrastructure substitution through off-grid and closed-loop resource systems. These practices extended machinery lifecycles, transformed waste into productive inputs, reduced dependence on imported materials and supported operational continuity amid energy and financial constraints. However, participants rarely described their actions using formal sustainability or circular economy terminology. Environmental benefits emerged primarily from cost pressures, resource limitations and survival imperatives. The study develops the concept of Survivalist Eco-Innovation to explain environmentally beneficial practices generated through the interaction of institutional friction, entrepreneurial bricolage and organisational survival. It contributes to eco-innovation, circular economy and sustainability transition scholarship by demonstrating that ecological adaptation may emerge through

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informal, decentralised and necessity-driven innovation rather than formal environmental governance alone.

Keywords: Survivalist Eco-Innovation; entrepreneurial bricolage; circular economy; institutional friction; Igbo-made ingenuity; frugal innovation; Nigerian SMEs; resource scarcity.

1. Introduction

Contemporary sustainability discourse remains shaped by what may be termed a Global Environmental Fallacy: the assumption that pathways towards ecological transition are universally transferable irrespective of differences in institutional capacity, infrastructural development, and political-economic conditions. While eco-innovation scholarship has generated important insights into how firms can reduce environmental impacts while maintaining competitiveness (Rennings, 2000; Horbach et al., 2012; Cainelli et al., 2020), much of this literature remains grounded in assumptions derived from advanced economies. Consequently, sustainability transitions are often presented as scalable processes driven by technological innovation, regulatory intervention, and circular business models (Köhler et al., 2019; Kiefer et al., 2021).

Although transition scholars increasingly acknowledge the uneven nature of sustainability transformations (Köhler et al., 2019; McLaren and Kattel, 2023), dominant circular economy and corporate sustainability frameworks continue to be built around conditions prevalent within the Global North, including stable electricity systems, functioning financial markets, digitized administrative infrastructures, and predictable regulatory regimes (Kirchherr et al., 2017; Geissdoerfer et al., 2018; Kirchherr et al., 2023). As a result, governance mechanisms such as ESG reporting frameworks, carbon accounting systems, and environmental auditing requirements often assume levels of organizational formalization and administrative capacity that many firms operating within emerging economies do not possess.

This reflects a broader large-firm bias within sustainability research. Eco-innovation studies frequently focus on organizations possessing dedicated sustainability departments,

sophisticated reporting systems, and substantial financial resources (Oduro, 2024). Circular economy frameworks similarly emphasize technologically intensive resource loops, digital traceability systems, and highly coordinated supply chains (Bocken et al., 2016; Pieroni et al., 2021). While appropriate in mature institutional environments, such models are less applicable in contexts characterized by infrastructural instability, financial constraints, and fragmented governance systems. Consequently, the literature often overlooks the sustainability pathways available to SMEs operating under conditions of persistent scarcity.

These limitations are particularly evident within many African entrepreneurial ecosystems. Rather than benefiting from stable institutional support, firms frequently operate within environments characterized by unreliable electricity provision, volatile exchange rates, constrained access to finance, fragmented supply chains, and inconsistent policy implementation (Adomako et al., 2021; Torkkeli et al., 2023). Under such conditions, the primary challenge is often not maximizing environmental performance through formal sustainability systems, but maintaining organizational continuity amidst chronic uncertainty.

This observation exposes a fundamental limitation within prevailing eco-innovation theory. Conventional sustainability frameworks typically link environmental performance to formal innovation investments, technological upgrading, and regulatory compliance (Horbach et al., 2012; Kiefer et al., 2021). Yet firms operating within institutionally constrained environments frequently rely upon informal adaptation mechanisms that remain largely invisible within these frameworks. Entrepreneurial bricolage provides an alternative lens through which to understand such behaviour by highlighting how actors creatively recombine

available resources under conditions of scarcity rather than waiting for ideal institutional conditions to emerge (Baker and Nelson, 2005; Desa, 2012; Mateus and Sarkar, 2024). Importantly, bricolage is increasingly understood not as a temporary response to constraint but as a durable innovation logic capable of generating novel products, business models, and adaptive organizational forms (Garud and Karnøe, 2003; Senyard et al., 2014; Guo et al., 2020).

This perspective suggests that many environmentally beneficial practices observable within emerging economies may be systematically overlooked because they fail to conform to dominant definitions of eco-innovation. Informal material reuse, repair cultures, resource substitution, decentralized energy systems, and locally improvised production processes rarely appear within ESG metrics or formal circular economy assessments despite generating meaningful environmental outcomes. The result is a paradox whereby firms operating under severe resource constraints may simultaneously exhibit substantial adaptive environmental behaviours while remaining largely invisible within mainstream sustainability measurement systems.

The Nigerian context provides a particularly valuable setting through which to examine these dynamics. Within Nigeria's manufacturing and commercial sectors, entrepreneurial systems commonly described as *Igbo-made* have attracted growing attention for their capacity to generate productive activity despite persistent infrastructural and institutional constraints. Frequently characterized as informal or technologically unsophisticated, these systems instead reveal sophisticated practices of material recovery, repair-based production, reverse engineering, component reuse, and decentralized manufacturing. Such activities emerge not from formal sustainability commitments but from prolonged exposure to scarcity, infrastructural unreliability, and restricted access to capital-intensive technologies. The resulting forms of resource efficiency challenge dominant assumptions that circularity necessarily depends upon advanced technological infrastructures and

highly coordinated industrial ecosystems (Kirchherr et al., 2023; Pieroni et al., 2021).

This study argues that understanding these dynamics requires moving beyond conventional institutional void perspectives that focus primarily on institutional absence. In many emerging economies, entrepreneurs must navigate not only weak institutions but also forms of institutional friction generated through policy inconsistency, infrastructural instability, regulatory fragmentation, and administrative uncertainty (Khanna and Palepu, 2010; McLaren and Kattel, 2023; Torkkeli et al., 2023). Under such conditions, environmental adaptation emerges less through formal sustainability strategies and more through survival-oriented responses to systemic constraints.

To theoretically explain these processes, the study adopts organizational bricolage as its primary analytical framework. Bricolage captures how entrepreneurs mobilize discarded materials, tacit technical knowledge, informal networks, and locally available resources to sustain productive activity despite persistent institutional constraints (Baker and Nelson, 2005; Fisher, 2012). Within the Nigerian context, such practices reveal how adaptive forms of eco-innovation emerge through everyday problem-solving rather than through formal sustainability governance.

Drawing upon qualitative evidence from Nigerian SMEs operating across manufacturing, recycling, logistics, and agri-processing sectors, this paper develops the concept of Survivalist Eco-Innovation. The study argues that environmentally beneficial practices frequently emerge through the interaction of institutional friction, resource scarcity, entrepreneurial bricolage, and organizational survival imperatives. In doing so, it contributes to eco-innovation, sustainability transition, and bricolage scholarship by demonstrating that circular adaptation may originate not only from formal environmental governance systems but also from the everyday adaptive practices of firms operating within conditions of institutional fragility and uneven development.

2. Theoretical Background: Institutional Voids and Organizational Bricolage

Contemporary debates surrounding sustainability transitions, circular economy adaptation, and eco-innovation remain heavily dependent upon institutional assumptions rooted in advanced capitalist economies. Much of the prevailing literature implicitly presumes the existence of coherent governance systems, enforceable environmental regulations, accessible green financing, infrastructural reliability, and relatively predictable market coordination mechanisms. Consequently, institutional deficiencies within emerging economies are frequently conceptualized through the language of institutional voids; spaces characterized by the absence or underdevelopment of formal market-supporting structures (Khanna and Palepu, 2010). While this framing has provided useful analytical insight into governance deficiencies across developing economies, it remains fundamentally limited because it often treats institutional weakness as passive incompleteness rather than as an active political-economic condition capable of producing predatory outcomes for entrepreneurial actors.

While institutional void theory has significantly advanced understanding of entrepreneurial behaviour within emerging economies, its dominant formulation remains primarily concerned with the absence, weakness, or underdevelopment of market-supporting institutions (Khanna and Palepu, 2010; Mair and Marti, 2009). The central analytical problem is therefore framed as one of institutional deficiency, where entrepreneurs must compensate for missing intermediaries, imperfect markets, and limited governance capacity. Although this perspective provides important insights into how firms navigate resource constraints and regulatory gaps, it risks reducing governance challenges to a technocratic problem of incomplete institutional development.

Such an interpretation may obscure a more complex reality observable across many postcolonial political economies, where

entrepreneurial constraints emerge not solely from institutional absence but from the active presence of governance structures that generate uncertainty, transaction costs, and operational disruption. In these contexts, firms frequently confront fragmented regulatory jurisdictions, overlapping taxation systems, inconsistent policy implementation, discretionary enforcement practices, and bureaucratic inefficiencies that extend beyond conventional understandings of institutional voids (Adomako et al., 2021; Torkkeli et al., 2023). The entrepreneurial challenge is therefore not merely how to innovate in the absence of institutions, but how to maintain productive activity in environments where institutions themselves may operate unpredictably and impose substantial adaptive burdens upon economic actors.

This distinction is theoretically significant because it shifts attention from institutional scarcity toward institutional friction. Whereas institutional voids describe conditions in which market-supporting structures are weak or absent, institutional friction refers to circumstances in which the interaction between multiple governance actors, administrative procedures, and regulatory systems generates cumulative obstacles that impede productive activity. Under such conditions, entrepreneurs must devote considerable organisational resources toward navigating bureaucratic complexity, managing regulatory uncertainty, and mitigating the operational consequences of policy inconsistency. Innovation therefore becomes embedded within broader processes of institutional navigation rather than being driven solely by market opportunity or technological advancement.

From a political economy perspective, these dynamics also challenge the assumption that public institutions necessarily function as developmental mechanisms supporting sustainability transitions. Sustainability governance frameworks frequently presume that environmental regulations, licensing systems, inspection regimes, and compliance requirements operate primarily to facilitate ecological objectives (Horbach et al., 2012; Köhler et al.,

2019). However, within contexts characterised by limited state capacity, weak accountability structures, and fragmented administrative authority, regulatory interventions may produce outcomes that diverge significantly from their formal intentions. Environmental governance can become unevenly implemented, selectively enforced, or administratively burdensome, creating additional costs for firms without necessarily generating corresponding environmental benefits (McLaren and Kattel, 2023; Sharma et al., 2023).

Consequently, formal governance structures cannot always be understood as neutral infrastructures supporting sustainable development. Rather, they may themselves constitute important components of the entrepreneurial environment that shape adaptation strategies, resource allocation decisions, and innovation trajectories (Mair and Marti, 2009; Khanna and Palepu, 2010; Adomako et al., 2021). For resource-constrained SMEs, the cumulative effect of regulatory fragmentation, infrastructural instability, and administrative uncertainty often redirects managerial attention away from long-term sustainability investments toward short-term organisational survival (Köhler et al., 2019; McLaren and Kattel, 2023; Sharma et al., 2023). Under these circumstances, entrepreneurial adaptation increasingly depends upon informal problem-solving capabilities, social networks, and resource recombination strategies capable of mitigating institutional disruptions (Baker and Nelson, 2005; Desa, 2012; Senyard et al., 2014; Mateus and Sarkar, 2024).

Recognising this distinction extends existing institutional void scholarship by demonstrating that the critical issue facing many firms in emerging economies is not simply the absence of effective institutions, but the coexistence of institutional weakness and institutional interference (Khanna and Palepu, 2010; Adomako et al., 2021; Torkkeli et al., 2023). The resulting environment is characterised by both governance deficits and governance frictions, producing a form of structural uncertainty that shapes how entrepreneurs innovate, allocate resources, and pursue sustainability objectives

(Mair and Marti, 2009; McLaren and Kattel, 2023). It is within this environment that bricolage becomes particularly significant, not merely as a response to resource scarcity, but as a strategic mechanism through which firms navigate the contradictions generated by uneven and often disruptive institutional landscapes (Fisher, 2012; Guo et al., 2020; Mateus and Sarkar, 2024; Yu et al., 2024).

This critique extends institutional void theory by arguing that governance gaps should not always be interpreted as institutional absences but rather as forms of institutional hostility. In many African economies, the state simultaneously appears over-present and under-effective; excessively intrusive in extractive practices while chronically absent in infrastructural provision. Entrepreneurs may therefore confront persistent electricity failures, deteriorating logistics systems, volatile exchange rates, and limited access to formal credit while simultaneously navigating dense layers of taxation, customs restrictions, import duties, and informal payment expectations. Such contradictions generate a structurally antagonistic business environment in which operational continuity itself becomes a form of adaptive achievement.

Within this context, the concept of organizational bricolage provides an especially valuable theoretical lens for understanding entrepreneurial adaptation. Originally developed by Lévi-Strauss (1966) and later extended into entrepreneurship studies by Baker and Nelson (2005), bricolage refers to the process of making do by applying combinations of the resources at hand to new problems and opportunities. Unlike conventional innovation frameworks that prioritize formal R&D systems, capital-intensive technological investment, and structured institutional support, bricolage foregrounds improvisation, recombination, experimentation, and opportunistic resource utilization under conditions of scarcity. The bricoleur does not innovate through access to ideal resources but through the creative reconfiguration of whatever materials, networks, competencies, and discarded assets remain available within constrained environments.

Baker and Nelson's (2005) foundational contribution demonstrated that entrepreneurial bricolage emerges most prominently within resource-constrained ecosystems where firms are systematically excluded from conventional market opportunities and formal capital access. Rather than perceiving resource scarcity solely as a limitation, bricolage-oriented firms reinterpret constraints as opportunities for recombination and adaptive problem-solving. This insight becomes particularly important when examining eco-innovation within emerging economies because access to imported green technologies, advanced recycling systems, renewable infrastructure, and sophisticated sustainability tools is often financially prohibitive for small ventures.

Consequently, firms operating within capital-constrained ecosystems are frequently compelled to construct alternative pathways toward operational sustainability through the creative deployment of locally available resources, tacit technical knowledge, informal repair networks, and adaptive resource recovery practices (Baker and Nelson, 2005; Desa, 2012; Senyard et al., 2014). Under such conditions, material flows that would ordinarily be classified as waste within highly formalized production systems may be reconfigured as productive inputs through processes of improvisation and recombination. Used mechanical components are repurposed for alternative industrial applications, electronic waste becomes a source of recoverable materials, damaged machinery is repeatedly modified beyond its intended lifecycle, and repair cultures substitute for costly technological replacement systems. These adaptive practices often generate forms of resource efficiency and material recirculation that resemble the objectives of circular economy models, even though they emerge under fundamentally different institutional and economic conditions (Garud and Karnøe, 2003; Bocken et al., 2016; Kirchherr et al., 2023). In this sense, circularity frequently arises not primarily from environmental ideology but from the practical necessity of operating under conditions of persistent resource scarcity.

This distinction is theoretically significant because dominant circular economy and sustainability transition narratives often portray eco-innovation as the outcome of strategic environmental awareness, regulatory incentives, market demand for sustainable products, or corporate legitimacy-seeking behaviour (Horbach et al., 2012; Geissdoerfer et al., 2018; Kiefer et al., 2021). While such drivers are undoubtedly important, they largely reflect institutional environments characterised by relatively stable governance systems, mature markets, and accessible sustainability infrastructures. As a result, much of the existing literature implicitly assumes that ecological adaptation is primarily motivated by environmental objectives rather than by broader struggles for organisational continuity. Such assumptions risk underestimating the extent to which eco-innovation within emerging economies may be shaped by fundamentally different incentive structures linked to infrastructural instability, institutional uncertainty, and chronic resource constraints (McLaren and Kattel, 2023; Sharma et al., 2023).

Within these contexts, environmental adaptation is often embedded within broader strategies of economic survival. Rather than being driven principally by regulatory compliance or reputational considerations, resource-efficient practices frequently emerge because inefficiency imposes immediate operational risks. This observation suggests the value of conceptualising a complementary form of eco-innovation that may be particularly relevant within institutionally fragile environments: Survivalist Eco-Innovation. Building upon existing eco-innovation theory (Rennings, 2000; Cainelli et al., 2020; Oduro, 2024) and entrepreneurial bricolage scholarship (Baker and Nelson, 2005; Fisher, 2012; Mateus and Sarkar, 2024), Survivalist Eco-Innovation refers to environmentally beneficial adaptive practices that emerge primarily from the imperative of maintaining productive activity under conditions of systemic scarcity rather than from formal sustainability objectives.

This framework differs from the dominant logic underpinning what may be described as

Compliance-Driven **Eco-Innovation.**
Compliance-driven models typically operate within institutional environments where environmental regulations, ESG reporting systems, carbon accounting frameworks, and sustainability incentives provide firms with both pressures and opportunities to pursue ecological innovation (Horbach et al., 2012; Kiefer et al., 2021; Oduro, 2024). Such approaches generally assume the availability of sufficient organisational resources, infrastructural support, and institutional stability to absorb the costs associated with environmental transition. Eco-innovation consequently becomes linked to competitive positioning, stakeholder legitimacy, reputational enhancement, and long-term strategic value creation (George et al., 2021; Konara et al., 2021).

By contrast, Survivalist Eco-Innovation emerges where formal sustainability infrastructures are weak, inaccessible, or economically secondary to more immediate operational concerns. Under these circumstances, waste minimisation occurs because replacement costs are prohibitively expensive; resource recirculation develops because import constraints and currency instability restrict access to new materials; repair cultures intensify because technological substitution remains financially unattainable; and energy improvisation becomes necessary because unreliable infrastructure threatens production continuity (Oyedepo, 2014; Adomako et al., 2021; Torkkeli et al., 2023). The resulting practices often generate environmental benefits, but these benefits are frequently incidental to broader efforts aimed at sustaining productive activity. Circular economic behaviours therefore evolve through adaptive responses to institutional and material constraints rather than through deliberate adherence to formal sustainability frameworks.

The analytical contribution of this perspective lies in its ability to challenge linear assumptions embedded within much of the sustainability transition literature. Existing frameworks often conceptualise ecological transformation as a progressive movement toward increasingly sophisticated, technologically advanced, and

formally regulated systems (Köhler et al., 2019; Kiefer et al., 2021). However, evidence from institutionally constrained environments suggests that environmentally beneficial outcomes may also emerge through decentralized, informal, and improvisational mechanisms that operate largely outside formal sustainability governance structures (Baker and Nelson, 2005; Guo et al., 2020; Mateus and Sarkar, 2024). Environmental closed loops may therefore arise not only through deliberate sustainability planning, but also through scarcity-induced efficiency and adaptive resource recombination. Recognising these alternative pathways broadens existing understandings of eco-innovation by demonstrating that ecological adaptation can originate from the everyday survival strategies of entrepreneurs navigating conditions of uneven development, institutional fragility, and persistent resource constraint.

The Nigerian context, particularly the entrepreneurial ecosystems associated with what is commonly described as *Igbo-made* industrial adaptation, provides a valuable empirical setting through which to explore these dynamics. Across informal manufacturing clusters, spare-parts markets, repair networks, and decentralized production systems, firms frequently operate under conditions characterised by infrastructural instability, constrained access to capital, and fragmented institutional support (Oyedepo, 2014; Adomako et al., 2021). Within such environments, productive activity often depends upon the intensive recovery, modification, reuse, and recirculation of materials that would otherwise be discarded within more formalized production systems. These adaptive practices frequently reflect forms of frugal engineering and resource recombination developed in response to prolonged exposure to institutional uncertainty and material scarcity (Baker and Nelson, 2005; Guo et al., 2020; Mateus and Sarkar, 2024).

Importantly, such activities remain largely invisible within orthodox sustainability assessment frameworks. Conventional circular economy metrics, ESG reporting systems, and carbon accounting architectures typically privilege formally documented environmental

initiatives occurring within regulated organizational settings (Geissdoerfer et al., 2018; Kirchherr et al., 2023; Oduro, 2024). Consequently, resource-efficient practices emerging through informal production systems are frequently excluded from dominant accounts of eco-innovation despite their potential contribution to waste reduction, product life extension, material recovery, and resource optimization. This analytical blind spot reflects a broader tendency within sustainability governance to equate environmental innovation with formal institutional compliance while underestimating adaptive practices emerging outside conventional reporting structures (McLaren and Kattel, 2023; Sharma et al., 2023).

Viewed through the lens of entrepreneurial bricolage, these systems may be interpreted as examples of distributed innovation operating through localized networks of technical knowledge, resource exchange, and adaptive problem-solving (Garud and Karnøe, 2003; Fisher, 2012; Senyard et al., 2014). Rather than relying upon formal research and development infrastructures, innovation emerges through iterative experimentation, tacit learning processes, social relationships, and the creative recombination of available resources. Such mechanisms suggest that environmentally beneficial forms of resource efficiency may arise through decentralized socio-technical arrangements that differ substantially from the institutional configurations typically assumed within mainstream circular economy models (Bocken et al., 2016; Pieroni et al., 2021).

Accordingly, this paper argues that bricolage should not be interpreted merely as a compensatory response to institutional underdevelopment. Rather, it represents a distinct mode of innovation production shaped by the political economy of institutional fragility and resource constraint (Baker and Nelson, 2005; Mateus and Sarkar, 2024). The significance of the *Igbo-made* phenomenon therefore lies not simply in its demonstration of entrepreneurial resilience, but in its potential to reveal how alternative socio-technical systems emerge when formal institutions fail to provide reliable support for

productive activity. Under such circumstances, resource recombination, repair-based production, and material recirculation may collectively generate forms of what this study conceptualizes as Survivalist Eco-Innovation—adaptive practices that produce environmental benefits while primarily serving the objective of organizational continuity.

Through the integrating of insights from institutional void scholarship, political economy perspectives on state capacity, and bricolage theory, this study advances a more politically grounded understanding of eco-innovation within emerging economies (Khanna and Palepu, 2010; Köhler et al., 2019; Torkkeli et al., 2023). Specifically, it argues that sustainability adaptation cannot be understood independently of the broader institutional environments within which firms operate. Eco-innovation is therefore conceptualized not merely as a response to environmental challenges, but as an adaptive outcome emerging from the interaction between institutional friction, resource scarcity, entrepreneurial bricolage, and the pursuit of organizational survival. This perspective broadens existing sustainability transition theory by demonstrating how environmentally beneficial forms of circular adaptation may emerge from the everyday practices of firms navigating conditions of uneven development and institutional fragility rather than from formal sustainability governance alone.

3. Methodology

This study adopts a qualitative research design informed by a critical realist ontology and a pragmatist epistemology to examine how eco-innovation emerges within institutionally fragile environments. The methodological approach is designed to move beyond descriptive accounts of sustainability practices and identify the deeper structural mechanisms shaping entrepreneurial adaptation under conditions of resource scarcity, infrastructural instability, and institutional constraint.

3.1 Philosophical Positioning

Critical realism provides the study's ontological foundation because it distinguishes between

observable events and the underlying causal mechanisms that generate them (Bhaskar, 1978; Sayer, 2000). Rather than assuming that empirical observations fully represent social reality, critical realism conceptualizes reality as operating across three domains: the empirical (what is observed), the actual (events that occur regardless of observation), and the real (the underlying structures and mechanisms that generate observable outcomes) (Bhaskar, 1978).

This perspective is particularly relevant for investigating eco-innovation in emerging economies. Observable practices such as material reuse, repair cultures, waste recovery, and energy improvisation represent only the empirical manifestations of deeper institutional and economic conditions. At the level of actual events, firms experience recurrent electricity disruptions, currency volatility, supply-chain constraints, and regulatory uncertainty. At the level of the real, these experiences are generated by broader mechanisms associated with institutional fragility, governance fragmentation, resource scarcity, and uneven development (Khanna and Palepu, 2010; Köhler et al., 2019; McLaren and Kattel, 2023). Consequently, understanding eco-innovation requires moving beyond environmental outcomes to examine the conditions that make particular forms of adaptation both possible and necessary.

Complementing this ontological position, the study adopts a pragmatist epistemology. Pragmatism prioritizes the development of contextually useful explanations and supports methodological flexibility when investigating complex social phenomena (Dewey, 1938; Morgan, 2014). This orientation is particularly appropriate because entrepreneurial adaptation within Nigerian SMEs frequently occurs through tacit knowledge, experiential learning, and informal problem-solving processes that are difficult to capture through standardized quantitative measures. The objective is therefore not to identify universal laws of eco-innovation, but to generate empirically grounded explanations of how adaptive sustainability practices emerge within specific institutional contexts.

Together, critical realism and pragmatism provide a complementary framework. Critical realism guides the search for underlying causal mechanisms, while pragmatism supports the development of context-sensitive explanations capable of accounting for the complexity of entrepreneurial behaviour in resource-constrained environments.

3.2 Research Context and Sample

The empirical focus of the study is Nigerian SMEs operating within manufacturing, recycling, logistics, and agri-processing sectors. Nigeria provides a particularly relevant setting because entrepreneurial activity occurs within conditions characterized by energy insecurity, exchange-rate volatility, inflationary pressures, constrained access to finance, and uneven institutional support (Oyedepo, 2014; Adomako et al., 2021; Torkkeli et al., 2023).

These conditions simultaneously restrict access to imported technologies, formal sustainability infrastructures, and conventional green innovation pathways while creating incentives for alternative forms of adaptive problem-solving. Firms frequently rely upon machine modification, material recovery, repair systems, localized engineering solutions, and informal procurement networks to sustain productive activity. Such practices remain largely underrepresented within mainstream eco-innovation research despite their potential environmental significance.

The study draws upon semi-structured interviews with ten SME owner-managers selected through purposive sampling. Participants were chosen because they operated in sectors directly exposed to material production processes and infrastructural dependency, thereby providing rich insight into how sustainability-related adaptations emerge under conditions of institutional constraint.

3.3 Data Analysis: The Gioia Methodology

Data were analysed using the Gioia methodology (Gioia et al., 2013). This approach was selected because it combines interpretive sensitivity with analytical transparency, enabling the systematic

progression from participant narratives to higher-order theoretical insights. The analysis began with the identification of first-order concepts grounded in participants' own language and interpretations. This stage was particularly important given the study's focus on vernacular entrepreneurial adaptation, as it reduced the risk of imposing externally derived theoretical categories onto context-specific experiences. First-order concepts were subsequently grouped into second-order themes representing broader patterns of meaning, before being synthesised into aggregate dimensions capable of supporting theoretical development (Gioia et al., 2013).

The Gioia methodology aligns closely with the study's pragmatist orientation because it privileges participant interpretations while maintaining analytical rigour. However, the analysis did not conclude at the level of description. Consistent with the study's critical realist foundations, abductive and retroductive reasoning were employed to move beyond observable practices and identify the deeper structural mechanisms shaping entrepreneurial adaptation (Bhaskar, 1978; Sayer, 2000).

This process involved asking not only what entrepreneurs were doing, but why particular adaptive practices emerged repeatedly across cases. Through iterative comparison between empirical observations and theoretical concepts, recurring patterns of bricolage, resource recombination, repair-based production, and material recirculation were interpreted as responses to broader conditions of institutional fragility, infrastructural instability, and resource scarcity.

3.4 Methodological Contribution

The integration of critical realism, pragmatism, and the Gioia methodology enables the study to move beyond descriptive accounts of entrepreneurial resilience toward a deeper explanation of how eco-innovation emerges within institutionally constrained environments. Rather than treating sustainability practices as isolated organizational outcomes, the methodological framework conceptualizes them as emergent responses to the interaction between

institutional conditions, resource constraints, entrepreneurial agency, and bricolage-based adaptation. This approach is particularly valuable for investigating what this study conceptualizes as Survivalist Eco-Innovation because it allows environmentally beneficial practices to be understood not simply as sustainability initiatives, but as adaptive responses to structural conditions. In doing so, the methodology provides a robust foundation for examining how circular economy practices emerge within contexts of institutional fragility and uneven development.

3.5 Critical Realist Use of the Gioia Methodology

The use of the Gioia methodology within a critical realist research design requires clarification because the approach is commonly associated with interpretivist traditions that prioritise actors' subjective meanings and lived experiences (Gioia et al., 2013). While interpretivism focuses on understanding how individuals construct and interpret social reality, critical realism seeks to move beyond actors' accounts to identify the deeper structural mechanisms that generate observable phenomena (Bhaskar, 1978; Sayer, 2000). Accordingly, the present study employs the Gioia methodology as an analytical tool for accessing entrepreneurial experiences rather than as an exclusively interpretive endpoint.

From a critical realist perspective, interview narratives are treated neither as direct representations of objective reality nor as purely subjective constructions. Rather, they constitute empirical evidence through which underlying causal mechanisms can be inferred. First-order concepts therefore capture how entrepreneurs experience and interpret institutional constraints, resource scarcity, infrastructural instability, and adaptive problem-solving within their everyday business activities (Gioia et al., 2013). These informant-centred accounts provide the empirical foundation for subsequent theoretical explanation.

However, the movement from first-order concepts to second-order themes and aggregate

dimensions extends beyond thematic categorisation. Consistent with critical realist reasoning, the analysis incorporates abductive and retroductive logic to identify the structural conditions underpinning recurring patterns of entrepreneurial behaviour (Bhaskar, 1978; Sayer, 2000). For example, repeated accounts of machine modification, waste recovery, repair-based production, and informal procurement networks were interpreted not merely as isolated firm-level practices, but as manifestations of broader mechanisms associated with institutional friction, resource scarcity, and entrepreneurial bricolage (Baker and Nelson, 2005; Mateus and Sarkar, 2024).

The combination of critical realism and the Gioia methodology therefore provides both analytical transparency and explanatory depth. While the Gioia approach offers a systematic pathway from participant narratives to conceptual themes, critical realism enables the analysis to move beyond description and explain why particular adaptive practices emerge under specific institutional conditions. This integration allows the study to preserve the authenticity of entrepreneurial voices while uncovering the deeper mechanisms shaping the emergence of Survivalist Eco-Innovation within institutionally fragile environments.

4. Findings: The Anatomy of *Igbo-Made* Bricolage

The findings reveal how SMEs operating within institutionally constrained environments generate adaptive forms of eco-innovation through resource recombination, improvisation, and localized problem-solving. Drawing on interviews with ten Nigerian SME owner-managers across manufacturing, recycling, logistics, and agri-processing sectors, the analysis examined how firms sustain productive activity amidst infrastructural instability, resource scarcity, macroeconomic volatility, and fragmented institutional support.

Consistent with the Gioia methodology (Gioia et al., 2013), the analysis progressed from first-order informant-centric concepts to second-order themes and aggregate dimensions. Three

recurring forms of entrepreneurial bricolage emerged from the data: (1) Material Bricolage through Waste-to-Value Adaptation, (2) Mechanical Bricolage through Informal Engineering and Technical Modification, and (3) Infrastructure Substitution through Off-Grid Resource Systems. Together, these dimensions capture the principal mechanisms through which firms mobilize available resources to mitigate institutional and infrastructural constraints.

A notable finding across all interviews was the absence of formal sustainability discourse. Participants rarely framed their actions in terms of circular economy principles, ESG compliance, carbon reduction, or environmental stewardship. Instead, adaptive practices were justified through concerns relating to cost reduction, operational continuity, resource availability, risk mitigation, and business survival. Material recovery, repair-oriented production, machinery modification, and alternative energy systems were pursued primarily because they reduced vulnerability to uncertainty rather than because they fulfilled explicit environmental objectives. Collectively, the findings suggest that circular adaptation within institutionally fragile environments follows a logic that differs markedly from the compliance-driven models commonly emphasized within mainstream eco-innovation literature (Horbach et al., 2012; Kiefer et al., 2021; Oduro, 2024). Rather than emerging through formal sustainability strategies, environmentally beneficial outcomes frequently arise through entrepreneurial efforts to manage scarcity, navigate institutional constraints, and maintain organizational continuity. The three aggregate dimensions presented below therefore provide empirical insight into the mechanisms through which bricolage generates what this study conceptualizes as Survivalist Eco-Innovation.

4.1 Theme A: Material Bricolage through Waste-to-Value Adaptation

The first major theme concerns Material Bricolage through Waste-to-Value Adaptation, whereby firms reconfigured waste materials and locally available inputs to maintain production amidst foreign exchange instability and rising

import costs. Participants repeatedly described how Naira depreciation and shortages of foreign currency had made imported virgin raw materials increasingly unaffordable, particularly within plastics, packaging, and light manufacturing sectors.

As one participant explained:

“The high cost of virgin plastic resin due to the dollar exchange rate. Petrochemicals are imported. When the dollar hit N1,500, we couldn't afford virgin pellets anymore. We had to innovate to use the ‘rubbish’ available locally.” (NG-SME-05)

The same participant described how the business subsequently shifted toward a fully recycled production process:

“We created a new product line using 100% recycled ‘pure water’ sachets to make black agricultural pipes. Before, we mixed in virgin material. Now, we have perfected the mix to use 100% waste sachet nylon.” (NG-SME-05)

These accounts indicate that waste materials were increasingly redefined as strategic production inputs rather than disposal burdens. Material recirculation emerged primarily as a response to resource scarcity and import dependence, with environmental benefits arising as a secondary outcome. Resource recovery therefore functioned as a mechanism for maintaining operational continuity under conditions of macroeconomic uncertainty.

The findings suggest that circular material flows can emerge through efforts to reduce vulnerability to currency volatility and input scarcity rather than through explicit environmental objectives. Material bricolage thus represents both an adaptive capability and a response to structural economic constraints.

4.2 Theme B: Mechanical Bricolage through Informal Engineering and Technical Improvisation

The second theme concerns Mechanical Bricolage through Informal Engineering and Technical Improvisation. Across interviews, participants identified high borrowing costs,

exchange-rate instability, and rising equipment prices as major barriers to technological upgrading. As a result, firms increasingly relied upon maintenance, repair, and modification capabilities to sustain productive activity.

One manufacturing-sector participant highlighted the importance of these capabilities:

“Our maintenance team. They are magicians. They keep 20-year-old machines running and find ways to bypass faults. Their ability to improvise is our biggest capability.” (NG-SME-01)

Participants described how technical personnel fabricated unavailable spare parts, modified imported machinery using local substitutes, and repeatedly reconfigured ageing production systems. The financial pressures underpinning these practices were equally evident:

“Commercial bank interest rates are hitting 30% to 35%. You cannot take a loan at that rate to buy solar panels that pay back in 4 years. The math doesn't work.” (NG-SME-01)

Similarly:

“Solar batteries and inverters are imported. With the Naira fluctuating against the Dollar, the price of replacing a battery bank has tripled in one year.” (NG-SME-01)

Evidence from the recycling sector further demonstrated how firms constructed and modified equipment using locally available materials:

“We call it ‘Igbo-made’ ingenuity—making do with what you have. Even here in the North, we respect the ability to fabricate machines locally from scrap metal.” (NG-SME-05)

Collectively, these findings reveal that repair, modification, and fabrication activities function as important technical capabilities rather than merely emergency responses to scarcity. Mechanical bricolage enabled firms to extend asset lifecycles and sustain production despite limited access to formal modernization pathways. At the same time, the continued reliance on ageing infrastructure reflects the broader financial and institutional constraints shaping entrepreneurial activity.

4.3 Theme C: Infrastructure Substitution through Off-Grid Closed-Loop Systems

The third theme concerns Infrastructure Substitution through Off-Grid Closed-Loop Systems, whereby firms developed localized energy solutions to compensate for unreliable electricity supply. Across interviews, participants consistently identified energy insecurity as one of the most significant threats to operational continuity.

As one manufacturing participant observed:

“It is the diesel for our Mikano generators. It is our number one priority because since the subsidy was removed, diesel has jumped from N800 to over N1,200 per litre. It is eating almost 50% of our operating cost.” (NG-SME-01)

The same participant emphasized the unpredictability of grid electricity:

“We might get 4 hours of light today and zero tomorrow. You can't run a production line on guesswork.” (NG-SME-01)

In response, firms increasingly developed alternative energy arrangements. Particularly notable were biomass-based systems that transformed agricultural waste into productive energy inputs. One agri-processing participant explained:

“We installed a biomass boiler specifically designed to burn cassava peels. In the past, we used diesel or firewood, which created a lot of smoke and cost a lot of money. Now, we dry the peels from our own processing line and feed them back into the boiler. It is a closed loop.” (NG-SME-02)

The participant further clarified the rationale behind the innovation:

“Cost savings and the availability of free waste material. The cassava peels were becoming a nuisance—heaps of rotting waste. Turning them into fuel solved a waste problem and a cost problem at the same time.” (NG-SME-02)

These findings demonstrate how energy insecurity and resource scarcity jointly encouraged the development of localized closed-

loop systems. Waste materials were transformed into energy resources capable of reducing fuel expenditure, improving operational resilience, and lowering disposal burdens. Environmental benefits emerged indirectly through efforts to address immediate business challenges rather than through formal sustainability initiatives.

Taken together, the three themes reveal a recurring pattern in which material recovery, technical improvisation, and infrastructure substitution functioned as adaptive responses to institutional and resource constraints. Across all cases, environmentally beneficial outcomes emerged through efforts to sustain productive activity under conditions of uncertainty, providing the empirical foundation for the concept of Survivalist Eco-Innovation developed in this study.

5. Discussion

The findings challenge dominant assumptions underpinning eco-innovation and sustainability transition research. Much of the contemporary literature remains implicitly grounded in the institutional realities of advanced economies, where ecological transformation is typically associated with formal regulation, ESG reporting systems, carbon accounting architectures, technological upgrading, and state-supported sustainability initiatives (Horbach et al., 2012; Geissdoerfer et al., 2018; Köhler et al., 2019; Kiefer et al., 2021). Within such contexts, eco-innovation is generally conceptualized as a strategic response to environmental regulations, market incentives, stakeholder pressures, or corporate sustainability objectives (Cainelli et al., 2020; Oduro, 2024). The evidence presented here suggests that these explanations only partially account for how environmentally beneficial practices emerge within institutionally constrained environments.

Across the cases, participants rarely framed adaptation in terms of sustainability, carbon reduction, or environmental stewardship. Instead, material recirculation, repair-oriented production, machinery modification, and waste-to-energy systems were justified primarily through concerns relating to cost reduction,

operational continuity, resource availability, and organizational survival. Environmentally beneficial outcomes therefore emerged less through formal sustainability governance than through adaptive responses to infrastructural instability, resource scarcity, and institutional uncertainty. Circularity, in this context, appears not as a deliberately planned sustainability strategy but as an unintended consequence of entrepreneurial adaptation under constraint. These findings extend organizational bricolage theory by demonstrating that bricolage is more than a resource-mobilization strategy employed during periods of scarcity (Baker and Nelson, 2005; Desa, 2012; Senyard et al., 2014). The evidence suggests that bricolage can function as a generative mechanism through which firms produce environmentally beneficial forms of innovation in the absence of supportive institutional infrastructures. Material recovery, informal engineering, repair-based production, and infrastructure substitution were not isolated responses to individual constraints; rather, they formed interconnected adaptive systems through which entrepreneurs continuously recombined available resources, tacit knowledge, informal networks, and localized technical capabilities. In doing so, they generated forms of resource efficiency and material recirculation that resemble the outcomes sought by circular economy frameworks, albeit through fundamentally different pathways (Garud and Karnøe, 2003; Guo et al., 2020; Mateus and Sarkar, 2024).

The findings also contribute to sustainability transition scholarship by highlighting the limitations of universalized transition models. Much of the literature assumes the availability of stable institutions, reliable infrastructure, formal governance systems, and accessible sustainability technologies (Köhler et al., 2019; McLaren and Kattel, 2023). However, the evidence suggests that transition pathways in emerging economies are often shaped less by regulatory ambition and technological sophistication than by institutional fragility and uneven development. Resource recovery, repair cultures, decentralized energy systems, and waste recirculation frequently emerged because entrepreneurs lacked viable

alternatives rather than because they were consciously implementing circular economy principles. This finding reinforces growing calls for more pluralistic understandings of sustainability transitions that recognise multiple, context-dependent pathways toward ecological adaptation.

Most significantly, the study advances the concept of Survivalist Eco-Innovation. The findings suggest that environmentally beneficial practices can emerge through the interaction of institutional friction, resource scarcity, entrepreneurial bricolage, and organizational survival imperatives. Unlike compliance-driven eco-innovation, which depends upon formal environmental incentives and governance structures, Survivalist Eco-Innovation originates from adaptive responses to infrastructural deficiencies, financial constraints, and systemic uncertainty. Circular practices therefore function not only as environmental interventions but also as socio-technical mechanisms for maintaining productive activity under adverse conditions.

This perspective broadens existing understandings of eco-innovation by demonstrating that ecological adaptation need not originate from environmental intention alone. Instead, sustainability outcomes may emerge through everyday entrepreneurial efforts to navigate institutional fragility and resource constraint. Recognising these alternative pathways is particularly important for advancing a more globally inclusive sustainability transition agenda, as it shifts attention away from narrowly defined compliance-based models and toward the diverse ways in which firms generate environmental value across uneven institutional contexts.

5.1 Bricolage as a Long-Term Operational Capability

The first theoretical contribution concerns the conceptual repositioning of bricolage. Existing bricolage scholarship largely portrays bricolage as a temporary response to resource scarcity, most commonly associated with early-stage ventures lacking access to capital, institutional support, or technological resources (Baker and Nelson, 2005;

Fisher, 2012). As firms mature, bricolage is generally assumed to be superseded by formal organizational systems, technological upgrading, and professionalized management structures (Senyard et al., 2014; Mateus and Sarkar, 2024).

The findings challenge this assumption. Across the sampled SMEs, bricolage did not diminish with organizational maturity but became embedded within operational routines and organizational capabilities. As one participant noted:

“Our maintenance team. They are magicians. They keep 20-year-old machines running and find ways to bypass faults. Their ability to improvise is our biggest capability.” (NG-SME-01)

Rather than functioning as an episodic response to scarcity, bricolage emerged as a durable socio-technical capability encompassing repair cultures, informal engineering systems, localized fabrication, and adaptive maintenance practices. These capabilities were continuously refined through repeated exposure to infrastructural instability, financial constraints, and technological exclusion.

This finding extends bricolage theory by suggesting that where resource scarcity is chronic rather than temporary, bricolage becomes institutionalized within the firm itself. Under such conditions, bricolage should be understood not merely as a substitute for formal innovation systems but as an enduring mechanism of organizational continuity. The contribution therefore shifts bricolage from the periphery of entrepreneurial adaptation to the centre of productive capability within institutionally fragile environments.

5.2 Reconsidering the Awareness-to-Action Gap

The second contribution concerns sustainability transition theory and the assumed relationship between environmental awareness and ecological action. Much of the sustainability literature assumes that environmentally beneficial behaviour emerges through environmental consciousness, stakeholder pressure, regulatory intervention, or explicit sustainability

commitments (Horbach et al., 2012; Kiefer et al., 2021; Oduro, 2024). Consequently, significant scholarly attention has focused on explaining why environmentally aware actors often fail to translate awareness into action.

The findings suggest a different dynamic. Participants rarely described their adaptive practices using environmental terminology. Waste recovery, repair-oriented production, resource recirculation, and energy substitution were overwhelmingly justified through concerns relating to cost reduction, resource availability, operational resilience, and business survival. As one participant observed:

“It wasn't about saving the planet; it was about keeping the gates open.” (NG-SME-01)

This evidence suggests the existence of an inverse awareness-to-action dynamic. Firms may engage extensively in environmentally beneficial practices without adopting formal sustainability identities, environmental narratives, or carbon-conscious vocabularies. Circular economy behaviours therefore emerge independently of sustainability discourse itself.

The implication is that environmental adaptation within institutionally constrained settings may be driven less by ecological awareness than by survival imperatives. Resource efficiency becomes economically necessary because inefficiency threatens organizational viability. Eco-innovation therefore emerges through material necessity rather than environmental ideology. This finding broadens sustainability transition theory by demonstrating that environmentally beneficial outcomes can originate from motivations largely absent from mainstream sustainability governance frameworks.

5.3 Reframing Environmental Metrics and Ecological Value

The third contribution concerns the conceptualization of environmental value. Contemporary sustainability assessment frameworks predominantly evaluate ecological performance through standardized indicators such as carbon emissions, ESG disclosures,

circularity metrics, and environmental reporting systems (Geissdoerfer et al., 2018; Kirchherr et al., 2023; Oduro, 2024). While these frameworks enhance comparability and accountability, they also privilege forms of environmental action that are formally documented and institutionally codified.

The findings suggest that many environmentally significant practices within emerging economies operate outside these reporting architectures. Participants frequently described waste recovery, biomass energy systems, and recycling initiatives in terms of sanitation, energy security, cost reduction, and productive resource use rather than carbon reduction or climate mitigation. As one participant explained:

“Turning them into fuel solved a waste problem and a cost problem at the same time.” (NG-SME-02)

This highlights a broader limitation within dominant sustainability metrics. Ecological value is often embedded within local struggles relating to public health, waste management, infrastructure deficits, and business continuity rather than formal environmental objectives. Consequently, conventional sustainability indicators may systematically underestimate the environmental significance of adaptive practices occurring within institutionally constrained environments.

Taken together, these findings support the concept of Survivalist Eco-Innovation, whereby environmentally beneficial practices emerge through the interaction of institutional friction, resource scarcity, entrepreneurial bricolage, and organizational survival imperatives. Unlike compliance-driven eco-innovation, Survivalist Eco-Innovation originates from adaptive responses to structural constraints rather than formal sustainability incentives. By recognizing these alternative pathways, the study contributes toward a more politically grounded and globally inclusive understanding of eco-innovation, sustainability transitions, and circular economy transformation.

6. Policy Implications: Rethinking Sustainability Governance in Institutionally Fragile Economies

The findings carry important implications for contemporary sustainability governance, particularly as environmental policy increasingly relies on ESG reporting systems, carbon disclosure mandates, digital traceability architectures, and formal sustainability auditing mechanisms to accelerate ecological transition (Köhler et al., 2019; Kiefer et al., 2021; Oduro, 2024). While these instruments play an important role in environmental accountability, they are largely designed around the institutional realities of highly formalized economies and may therefore be less effective when transferred uncritically to institutionally fragile contexts.

At the heart of this challenge lies a persistent large-firm bias. Contemporary sustainability governance frameworks generally assume the existence of stable accounting systems, digitized supply chains, reliable infrastructure, dedicated compliance personnel, and sufficient organizational slack to absorb the costs of environmental monitoring and reporting (Geissdoerfer et al., 2018; Kirchherr et al., 2023). Such assumptions may be appropriate for multinational corporations, but they are often detached from the realities facing SMEs operating under conditions of energy insecurity, financial exclusion, exchange-rate volatility, and institutional fragmentation.

The evidence suggests that many SMEs are not constrained by a lack of environmental ambition, but by the absence of the material conditions necessary to engage with increasingly complex compliance architectures. Under such circumstances, expanding carbon reporting requirements and digital traceability systems risks creating exclusionary governance structures that privilege firms already integrated into formalized production networks while marginalizing smaller enterprises operating through adaptive and informal modes of innovation (McLaren and Kattel, 2023; Sharma et al., 2023). Sustainability governance may therefore become increasingly effective at measuring codified environmental

performance while simultaneously overlooking environmentally beneficial practices that occur outside formal reporting systems.

The findings demonstrate that waste recirculation, repair-based production, localized equipment fabrication, biomass energy substitution, and decentralized resource recovery systems can generate significant environmental benefits despite remaining largely invisible within conventional ESG frameworks. This suggests the need to shift policy attention from measuring sustainability compliance alone toward strengthening the adaptive capacities that enable environmentally beneficial innovation under conditions of constraint. Three policy priorities emerge.

First, policymakers should recognize informal engineering and repair ecosystems as legitimate sites of innovation. The study demonstrates that maintenance networks, localized fabrication capabilities, repair cultures, and tacit technical expertise function as critical productive infrastructures within resource-constrained environments. Yet these capabilities remain largely absent from industrial and sustainability policy. Targeted support through vocational training programmes, fabrication grants, technical upgrading initiatives, and accessible equipment financing could simultaneously enhance industrial resilience and environmental performance.

Second, sustainability policy should be integrated more closely with industrial development policy. Much of the observed Survivalist Eco-Innovation emerged as a defensive response to unreliable electricity supply, exchange-rate instability, and restricted access to productive technologies. While such pressures stimulated adaptive resource efficiency, they also constrained long-term investment and upgrading. Sustainable industrial transformation therefore depends not only on environmental regulation but also on improvements in energy infrastructure, access to finance, technological capability development, and macroeconomic stability (Adomako et al., 2021; Torkkeli et al., 2023).

Third, policy interventions should engage more directly with the social infrastructures that support adaptive innovation. Across the cases, knowledge diffusion, resource circulation, and problem-solving frequently occurred through apprenticeship systems, supplier networks, community associations, and localized trust-based relationships. These informal institutions often perform innovation-support functions that formal systems fail to provide. Sustainability programmes are therefore likely to be more effective when they complement existing community-based innovation networks rather than attempting to replace them through exclusively top-down approaches.

More broadly, the study calls for a reconsideration of how ecological value is recognised within global sustainability governance. Existing environmental metrics remain heavily oriented toward standardized reporting architectures and compliance indicators. While valuable, such measures capture only a subset of environmentally beneficial activity. The evidence presented here suggests that ecological value frequently emerges through efforts to address energy insecurity, waste accumulation, resource scarcity, and organizational survival. A more inclusive sustainability governance framework must therefore recognise both formal environmental performance and contextually embedded forms of adaptive eco-innovation.

Ultimately, the central policy lesson is that sustainability transitions in institutionally fragile environments cannot be achieved simply by extending Global North compliance models to the Global South. The findings demonstrate that environmentally beneficial innovation frequently emerges through localized processes of bricolage, resource recombination, and adaptive problem-solving shaped by conditions of scarcity and uncertainty. Rather than treating such practices as deviations from ideal sustainability pathways, policymakers should recognise them as legitimate and potentially scalable forms of ecological adaptation. By foregrounding Survivalist Eco-Innovation, this study highlights the need for sustainability governance systems that value not

only compliance capacity but also the adaptive capabilities through which environmental

resilience is generated under conditions of constraint.

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