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Schools of Scarcity: Rethinking Architecture in Africa through Critical Regionalism and Community-Based Design

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Abstract

This study investigates contemporary school architecture in Africa through the theoretical frameworks of critical regionalism and the architecture of scarcity, with a focus on local context and socio-cultural dynamics. Eight schools were examined using qualitative content analysis, evaluating design and construction processes in relation to resource limitations and community needs, guided by locality-based design criteria. The findings indicate that strategies such as the integration of local knowledge, climate-sensitive design, the use of local materials and construction methods, and participatory processes are discussed in relation to environmental performance, cultural practices, social resilience, and collective use of educational spaces within the analyzed sources. The case studies suggest that schools designed under scarcity-driven conditions function not only as infrastructural facilities but also as socially embedded environments associated with pedagogical experimentation, community engagement, and cultural continuity. This paper argues that the intersection of critical regionalism and scarcity-based methodologies provides an analytical framework for examining architectural production in resource-constrained contexts, producing design strategies that are discussed in relation to resistance to global homogenization and debates on social sustainability.

1.0 INTRODUCTION

Across many regions of Africa, limited economic resources, infrastructural constraints, and uneven access to public services continue to shape the conditions under which educational environments are produced. Within this context, school buildings function not only as sites of formal learning but also as spatial interfaces where architectural decisions intersect with social organization, local construction practices, and environmental conditions. The rationale for examining school buildings in Africa stems from the fact that living conditions in many regions constrain access to education (UNICEF, 2021), while the schools developed under such conditions have been discussed in the literature as offering context-responsive responses within what has been termed the architecture of scarcity (Till, 2012; 2014). Education constitutes a fundamental necessity across geographies, and the design, construction, and use of school buildings play a significant role in shaping its accessibility. In contexts where formal educational infrastructure is limited or absent, the participation of local communities in construction processes has been documented as influencing how spatial production is organized and experienced (Kéré, 2019). Beyond a physical structure, such processes are often described as collective practices that bring together local knowledge, labor, and resources. In this regard, the construction of shared educational buildings has been framed in the literature as one manifestation of participatory and community-based architectural approaches (Poveda Burgos, 2025; Ma et al., 2019). Studies of school projects developed under conditions of material and economic constraint suggest that limited resources can give rise to inventive, context-specific design strategies associated with the architecture of scarcity (Becerra Santacruz, 2010). Community involvement in these processes extends beyond providing economic or technical contributions; it aligns with the principle of inclusiveness, ensuring that spaces become socially sustainable, accessible, and collectively owned.

Frampton (1983) argues that, in response to the anonymizing tendencies of modernism, architectural production should engage with geographical, cultural, and climatic specificities. Rather than treating critical regionalism as a normative or deterministic framework, the present study draws on Frampton's position as an analytical reference for examining how locality is articulated in architectural practice. This perspective is relevant to selected African contexts characterized by limited economic resources alongside enduring construction knowledge and social networks, without assuming a homogeneous or universal condition across the continent. Informed by Frampton's theoretical propositions and subsequent critical discussions (Canizaro, 2007), the study develops a set of locality-based design criteria and employs them as analytical tools. The research adopts a conditional purposive sampling strategy (Fridah, 2002; Patton, 1990) to examine eight school projects situated in different African contexts through qualitative content analysis of secondary sources such as architectural documentations, project reports, academic/professional sources and visual materials (Figure 1-2). The aim of the article is to examine these schools through the lens of locality-based criteria and to analyze how spatial and social dimensions are articulated in relation to design strategies developed within the framework of scarcity-driven architecture. In doing so, the study examines how school buildings produced under conditions of scarcity are represented in architectural documentation and related secondary sources as alternative educational environments and community-oriented architectural practices.

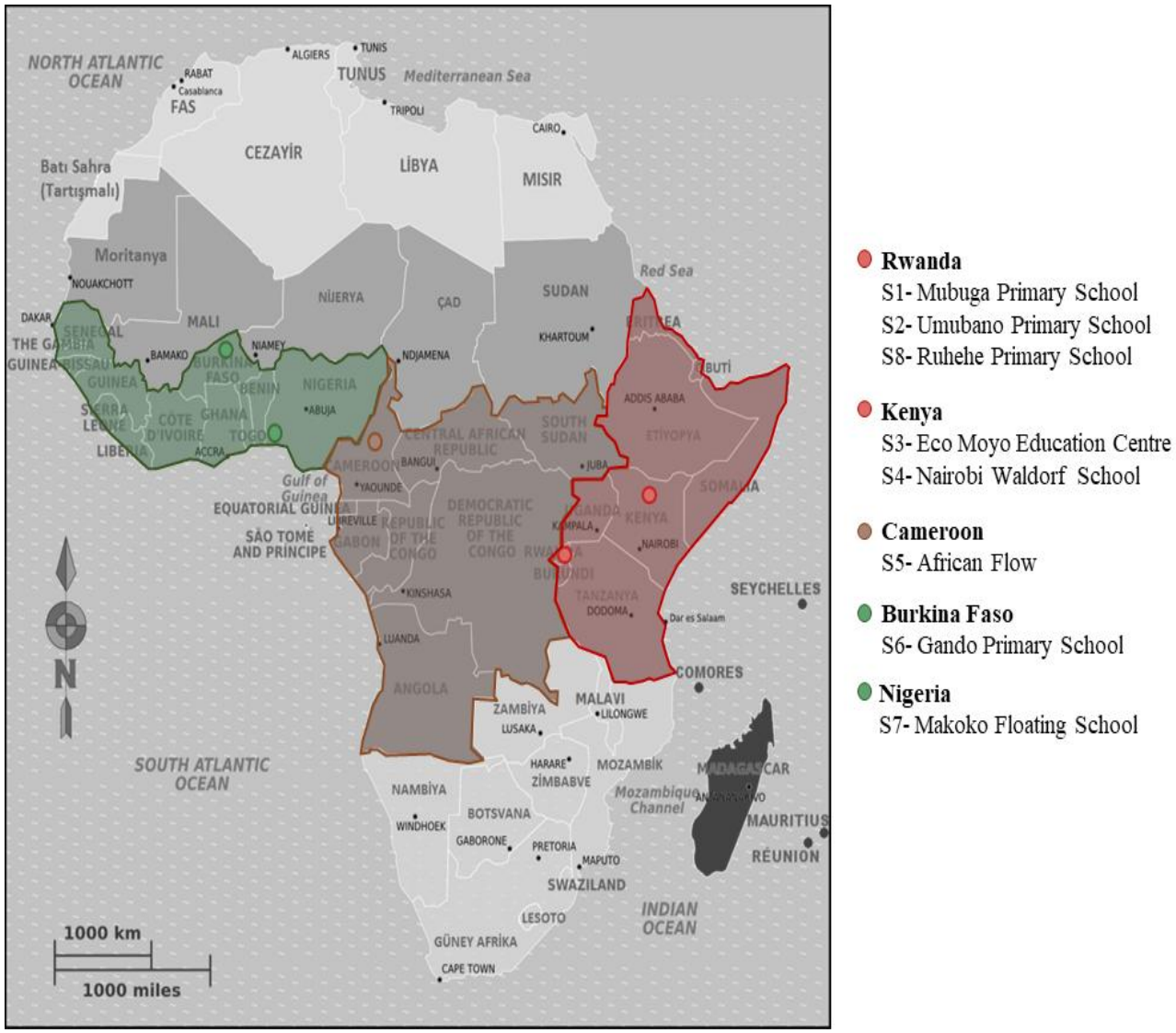


Figure 1. The map showing the context of the schools (Source of map base: Wikipedia, n.d.).

Within the scope of this study, the eight schools (Figure 1), each situated in distinct environmental and cultural contexts, were analyzed according to locality-based design criteria developed from the theoretical framework. Following this analysis, the data were coded according to predefined analytical categories, and recurring themes were synthesized and interpreted. The findings section discusses the extent to which each criterion was evident or absent across the schools. The analytical process was structured through a transparent workflow that links case selection, secondary data sources, coding, and interpretation. The study comparatively examined social claims regarding community participation, institutional constraints, and collective production across architectural documentation, published reports, and academic sources to ensure source traceability, as illustrated in the research workflow (Figure 2). This approach ensures that interpretative claims are grounded in verifiable secondary evidence rather than descriptive inference. Furthermore, the study examines site-specific design strategies developed within the frameworks of critical regionalism and architecture of scarcity, and considers how such practices are articulated in relation to architectural literature and professional applications. In this sense, the analyzed school projects are discussed, within the examined sources, as educational environments that extend beyond their functional role and are associated with resilience, cultural continuity, and collective forms of creativity at the community level.

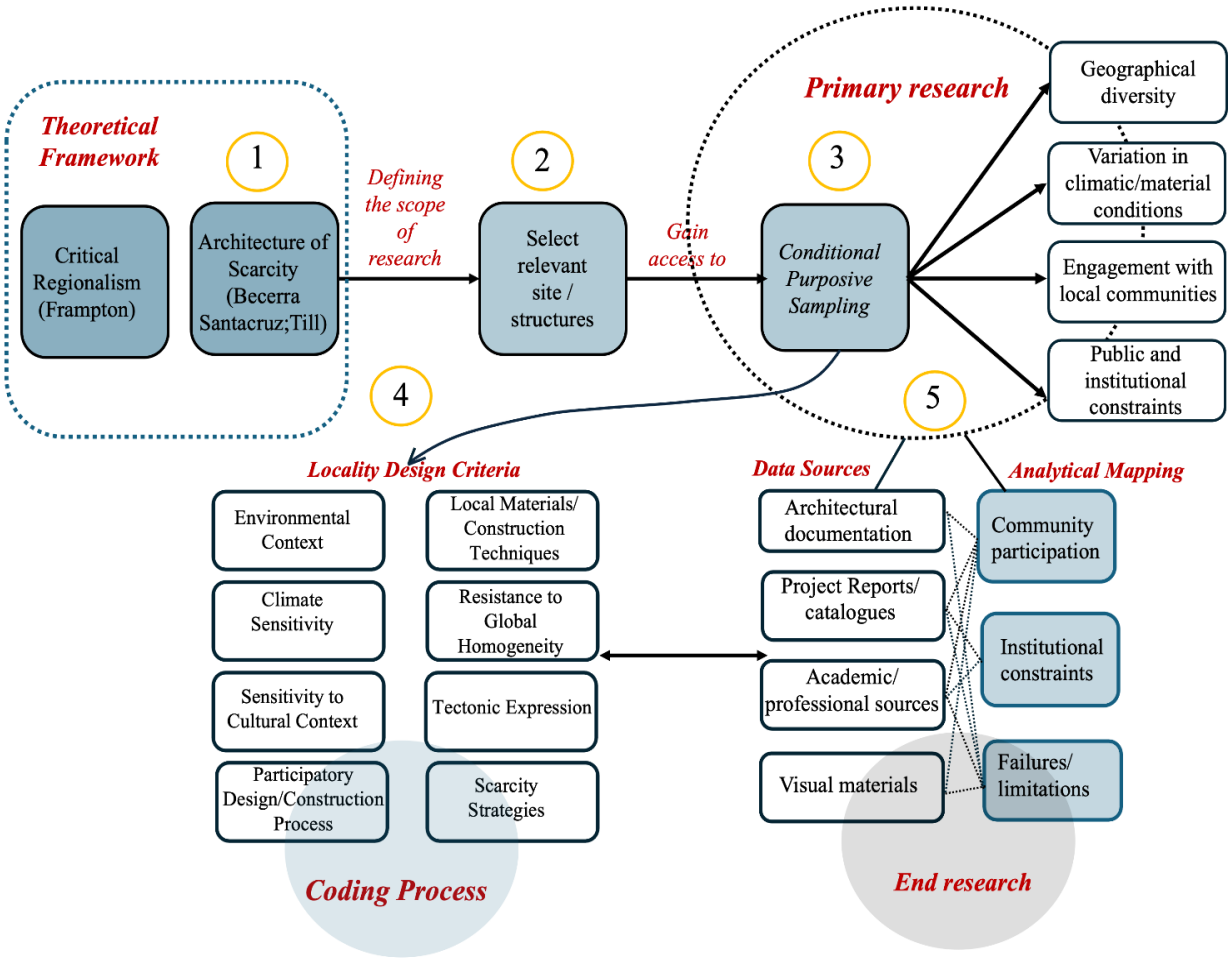


Figure 2. Overview of the research design and workflow process (Authors, 2026).

2.0 METHODS

This study employs a qualitative research methodology based on conditional purposive sampling to examine eight school buildings across Central, West, and East Africa. The sampling strategy was designed to capture contextual diversity, institutional constraints, and varying degrees of material, economic, and regulatory scarcity. A qualitative approach is particularly suited to this research, as it enables an in-depth examination of socio-spatial dynamics and cultural meanings embedded in architectural production under conditions of scarcity. The research design follows a conditional purposive sampling method (Fridah, 2002; Patton, 1990), which allows cases to be selected for their capacity to reveal how architectural practices respond to specific contextual challenges rather than for representativeness or performance outcomes. Case selection was guided by a set of explicitly defined inclusion and exclusion criteria. Inclusion criteria comprised: (1) geographical diversity (rural, urban, coastal, and floating contexts), (2) variation in climatic and material conditions, (3) documented engagement with local communities during design and/or construction, and (4) exposure to public, institutional, or regulatory constraints affecting design decisions. Exclusion criteria included projects lacking sufficient documentation of design processes, projects driven exclusively by commercial development logics, and cases where community participation or institutional negotiation could not be substantiated.

From an analytical perspective, the selected cases include projects that encountered significant institutional, regulatory, or construction-related challenges, such as funding limitations, material shortages, policy restrictions, or structural failures. These constraints are treated as central analytical dimensions that allow the study to critically examine the potentials and limitations of community-based and scarcity-oriented architectural practices.

The theoretical framework is grounded in Frampton's (1983) concept of critical regionalism, operationalized through locality-based design criteria such as environmental context, cultural sensitivity, tectonic expression, and participatory design, etc. These criteria were systematically applied as evaluative tools to enable structured comparison of the design approaches. In addition, the concept of architecture of scarcity (Becerra Santacruz, 2010) was adopted to frame resource-driven innovations emerging from each project.

Data collection was based on secondary sources, including architectural documentation, project reports, published literature, and visual materials. In this study, spatial claims are derived from architectural drawings, plans, sections, and visual documentation, while social claims are considered only where explicitly reported in peer-reviewed publications, institutional reports, or project documentation. Each school was examined through a qualitative content analysis process, wherein the textual and visual data were coded according to the predefined locality criteria. The coding process facilitated the identification of recurring themes, distinctive strategies, and context-specific design approaches across the eight cases. Subsequently, the coded data were synthesized into thematic clusters, enabling a comparative analysis of similarities and differences among the schools. The final stage of the methodology involved interpreting the findings in relation to broader architectural discourse. By situating the empirical results within relevant theoretical frameworks, the study examines how locally embedded practices and scarcity-driven design strategies are discussed in relation to architectural theory and practice.

2.1 Critical Regionalism and The Architecture of Scarcity: Contextual Strategies in African School Design

In African contexts, "the local" is frequently produced and mediated through global networks rather than existing as an autonomous or bounded condition. Regionalism therefore warrants examination not only as an architectural or cultural expression but also as a mode of governance and spatial production shaped by colonial legacies, global trade networks, transnational actors, and institutional power relations (Bach, 2015). From this perspective, postcolonial critiques caution against treating critical regionalism as inherently emancipatory in African settings. Scholarship has shown that principles often framed as modernist, yet context-sensitive have historically been mobilised to reproduce colonial and exclusionary spatial orders, revealing the political and ideological limits of such approaches (Müller-Friedman & Friedman, 2023). Louw (2021) further conceptualises architectural production through global–local tectonic encounters, arguing that critical regionalism functions less as a fixed "resistant" model than as a context-dependent method whose meanings and effects vary. By foregrounding how the vernacular is frequently assigned through an external "alien gaze," Louw demonstrates that Frampton's critical regionalism can be reduced, in practice, to the mediation of Northern-centred normative technologies through local techniques rather than operating as a consistently transformative framework.

Taken together, these debates indicate that critical regionalism in African contexts cannot be approached as a neutral or universal paradigm; it requires continuous reassessment through locally situated knowledge systems, production processes, and socio-economic conditions (Folkers, 2011; Martynenko & Kudriashova, 2025). In parallel, Jackson et al. (2025) show that modernist architectural practices have often been legitimised through discourses of climatic adaptation, rationality, and functionality, while corporate interests, logistical efficiency, and colonial hierarchies remained structurally decisive. Their analysis suggests that local materials, passive climatic strategies, and regional forms do not automatically constitute resistance; they can also be instrumentalised to sustain imperial trade networks and corporate spatial orders, underscoring that context-responsiveness should not be presumed ethical or locally emancipatory.

Frampton's theory of critical regionalism (1983) provides an important conceptual framework for school architecture in Africa by foregrounding the role of local context in architectural production. By challenging the homogenising tendencies of modern architecture, critical regionalism emphasises context-specific practices grounded in geography, climate, material culture, construction techniques, and socio-economic conditions (Yıldız Kuyrukçu & Özkan, 2023). Vernacular architecture, understood as a product of intertwined environmental, social, economic, and cultural factors, is therefore characterised by environmental responsiveness, functional adaptability, and its capacity to support community participation. In contrast to

universalised modernist models, Frampton argues that architectural production should emerge from these contextual specificities, a position that gains particular relevance in African contexts where material scarcity coexists with strong traditions of building knowledge and social organisation (Frampton, 1983; Canizaro, 2007).

Among the key principles of critical regionalism is adaptation to topography, whereby buildings engage with the terrain rather than imposing abstract formal logics upon it. Many rural African schools demonstrate this principle through spatial configurations that respond to landform while achieving both functional performance and architectural coherence (Kéré, 2019; Mileto, Vegas & García-Soriano, 2024). Climate sensitivity constitutes another central dimension, articulated through passive design strategies such as natural ventilation, shading, and controlled daylighting, which enhance environmental comfort and reduce dependence on mechanical systems (Codjoe & Kiconco, 2023; Veta, 2024). Equally significant is sensitivity to cultural context: schools are frequently conceived not only as educational facilities but as social infrastructures embedded within everyday communal life, often accommodating multiple programmes and collective activities (Özkan, 1985; Uduku, 2006).

Frampton further underlines the role of local materials and construction methods, which have shifted from being associated solely with necessity to becoming strategies for sustainability, cultural continuity, and community engagement. Materials such as adobe, bamboo, stone, reed, and timber are widely used due to their climatic suitability, affordability, and environmental performance (Azouqah et al., 2021; Golden, 2017; Agboola & Zango, 2025; Sore et al., 2018). Vernacular building practices thus operate not only as technical responses but also as carriers of cultural values, belief systems, and social norms, positioning architecture as a mediator between cultural heritage and sustainable development (Lamzah, 2025). Recent scholarship emphasises that material choices can actively resist global homogenisation while reinforcing a sense of place, particularly when local communities are directly involved in construction processes, thereby strengthening social ownership and collective belonging (Sun, 2024; Pandey & Tyagi, 2022; Nguluma, 2008).

Within contemporary architectural discourse, community participation is widely recognised as a core component of social sustainability and resilience. Participatory design is also a process that is political, selective, and shaped by power relations. Approaches that emphasize community participation, local building knowledge, and incremental construction processes aim to generate alternatives to the legacy of imposed architectural models and to reintegrate educational spaces into their social contexts (Kéré, 2019). Participatory and co-production models reposition local populations from passive users to active agents involved in planning, design, construction, and post-occupancy processes (Poveda Burgos, 2025; Ma et al., 2019). Architectural production is thus understood as both a spatial and social process shaped by shared knowledge, collective labour, and local economies (Lepik, 2010; Ren, 2016). Tectonic expression, another principle emphasised by Frampton, foregrounds the visibility of construction systems and techniques, which he frames as both an aesthetic and ethical concern (Frampton, 1983). In educational settings, such transparency carries pedagogical value, allowing the building itself to function as a learning medium (Olweny, 2018).

These principles intersect with humanitarian architectural practices in contexts marked by poverty, inequality, or crisis, where architecture is increasingly associated with social responsibility, justice, and solidarity (Charlesworth, 2006; 2014). African school projects that combine local materials with participatory processes exemplify this overlap, integrating the formal strategies of critical regionalism with broader social commitments (Boylston, 2019; Idem, Zielonko-Jung & Karpińska, 2022). Well-known examples such as the Gando Primary School in Burkina Faso and the Makoko Floating School in Nigeria illustrate both the potential and the limits of these approaches. While Gando demonstrates material innovation through community-based construction, Makoko, despite its eventual structural failure, remains a critical experiment in local knowledge, climatic adaptation, and collective agency (Kéré Architecture, n.d.; Okeke et al., 2019).

The discourse is further extended through the concept of the architecture of scarcity. Becerra Santacruz (2010) conceptualises scarcity not as a deficit but as a methodological condition that foregrounds process, adaptability, and relational practices. This perspective aligns with Frampton's emphasis on context while addressing global inequalities by shifting attention from object-centred production to socially embedded

architectural processes. Jeremy Till advances this argument by reframing scarcity as a socially, materially, and politically constructed condition rather than a neutral background constraint (Till, 2014; Till et al., 2014). His distinction between austerity and scarcity is particularly significant, as it resists reducing architecture to logics of efficiency, cost minimisation, or neoliberal restraint.

Applied to African school architecture, these theoretical perspectives allow conditions commonly labelled as scarcity, limited resources, reliance on local materials, and non-industrial construction techniques, to be interpreted as contextual capacities rather than indicators of deprivation. Community-based school projects demonstrate how vernacular knowledge, collective labour, climatic expertise, and social organisation actively shape architectural production. In line with Till's understanding of design as a form of agency operating through processes rather than objects, African school buildings can therefore be read as spatial frameworks through which local knowledge is activated, negotiated, and sustained over time (Till, 2012; 2014).

In the African context, scarcity is perceived in architectural production processes both as a pragmatic necessity and an innovative approach; however, it must be assessed within the framework of long historical continuities shaped by colonialism, extractive political economies, and uneven institutional development processes (Demissie, 2012; Myers, 2011). Colonial architecture, through educational, administrative, and healthcare buildings, spatially reproduced power while largely overlooking local spatial practices, climatic knowledge, and community-based ways of life (Demissie, 2012). These imposed spatial models have left lasting traces on educational infrastructure in the post-independence period.

In the postcolonial era, scarcity is linked to development paradigms directed by international institutions, donors, and transnational NGOs. UNESCO-led school construction programs transferred Western educational and spatial epistemologies to Africa and reinforced asymmetries between local knowledge systems and global expertise (De Raedt, 2014). According to Mkandawire (2001), scarcity and development issues in Africa should be understood not as technical deficiencies but as structural conditions historically produced by colonial governance, externally dependent production systems, and international development regimes. Studies on African urbanization and architectural history emphasize the continent's heterogeneity, shaped by different colonial administrations, political economies, ecological zones, and governance structures (Myers, 2011; Njoh, 2016). In this context, treating Africa as a singular political-economic entity is misleading; state capacity should be understood as a historically constructed domain of competence, built through long-term public investment, institutional learning, education, and knowledge production. Consequently, educational infrastructure and public spaces must be regarded both as outputs of development and as its constitutive components. In Sub-Saharan Africa, colonial-era concession economies and labor regimes shaped the formation of unequal social infrastructures, including education and social welfare services, largely driven by labor scarcity, international pressures, and extractive imperatives rather than development objectives (Künzler, 2022). These dynamics constrained post-independence state institutional capacity and continue to influence current educational infrastructure. Accordingly, scarcity emerges as a structural condition rooted in colonial legacies, global economic dependencies, and uneven state formation processes (Moradi, 2008; Ocheni & Nwankwo, 2012; Olatayo, 2025). Colonial governance models, labor regimes, and development trajectories have varied significantly across regions, producing unequal social and spatial outcomes (Moradi, 2008; Künzler, 2022). Similarly, architectural and educational infrastructures reflect multiple modernities rather than a singular condition of scarcity or social cohesion (Adeyemo & Amole, 2023; Livsey, 2014). This study situates school projects in West, Central, and East Africa within distinct colonial and postcolonial historical trajectories, aiming to avoid continental generalizations and instead highlight differentiated architectural approaches shaped by specific institutional and socio-historical contexts (Demissie, 2012; Longair, 2016).

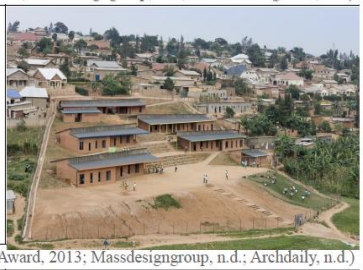
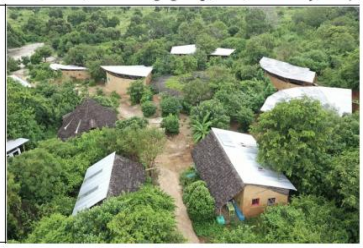
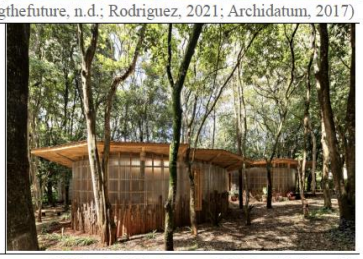
Within architectural theory, critical regionalism offers a productive conceptual framework for addressing these complexities. Critical regionalism does not adopt an approach that elevates locality or scarcity as an aesthetic or ethical virtue. Instead, it addresses the tension between global powers and local specificities through climate, material culture, and social practices, while taking period-specific conditions into account (Frampton, 1983). In this perspective, African school projects illustrate how critical regionalism and the architecture of scarcity intersect to produce buildings that operate not only as functional objects but also as

collective social processes. Through strategies such as topographic integration, climatic adaptation, cultural sensitivity, the use of local materials, community participation, and tectonic expression, these projects develop alternative models to standardized educational typologies and negotiate the pressures of global homogenisation. Rather than positioning scarcity as a purely limiting condition, the cases examined demonstrate how architectural practice engages with constraint as a relational and context-dependent condition, contributing to ongoing debates on how architecture operates under conditions of material, institutional, and social limitation.

3.0 FINDINGS

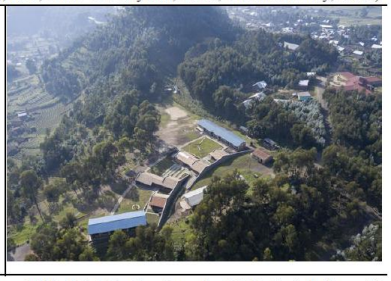
The findings section presents the results of the qualitative content analysis of eight contemporary school projects located in Rwanda, Kenya, and other African regions. The analysis focuses on how architectural design approaches engage with local contexts, material practices, environmental conditions, and social dynamics, based on secondary sources and predefined locality-based criteria (Tables 1–2).

Table 1. Schools examined within the case study framework.

Code	Identity Information	Design Characteristics	Structure + Context
S1	Mubuga Primary School Location: Rwanda, East Africa Year: 2015 Architecture: Mass Design Group	A practical/learning site for young ADC designers 13 classrooms/Teachers' offices/Library/Community pavilion Infrastructures facilitating access to water Integration of all buildings w/ a central road+open playgrounds Lo-Fab (Local Fabrication) approach Women weaving roof insulation from reeds Local labor and materials Contribution to community memory+local economy Sustainable model	 Sources: (Benimana, 2018; Massdesigngroup, n.d.; Architectmagazine, n.d.)
S2	Umubano Primary School Location: Rwanda, East Africa Year: 2010 Architecture: Mass Design Group	Pedagogical flexibility w/spatial solutions 9 classrooms/Administrative block/Library/ computer center Spatial organization by age-specific platforms Enhanced safety through separated learning areas Terraced landscape design Outdoor seating/play areas/Amphitheater-like community spaces Flexible courtyards for extracurricular activities Context-sensitive design Spatial continuity	 Sources: (Aga Khan Award, 2013; Massdesigngroup, n.d.; Archdaily, n.d.)
S3	Eco Moyo Education Centre Location: Kenya, East Africa Year: 2017 Architecture: The Scarcity and Creativity	Community-based educational initiative Montessori-based pedagogy+Green School principles Ethics, ecology, critical thinking, communication skills Classrooms/teachers' housing/kitchen/student dormitories Education, housing, nutrition, and socialization combined Stone plinth integration with natural environment Semi-permeable partitions for social interaction Public surfaces fostering community engagement Integrated community hub	 Sources: Lervik & Waitz, 2022; Archdaily, n.d.; Re-thingkingthefuture, n.d.; Rodriguez, 2021; Archidatum, 2017)
S4	Nairobi Waldorf School Location: Kenya, East Africa Year: 2024 Architecture: Urko Sánchez Architects	Integration of pedagogy and spatial organization Zoning for kindergarten, primary, and secondary levels Spiral forms inspired by Maasai manyata settlements Cultural references and environmental adaptation Experiential and applied learning Context-sensitive educational environment Organic spatial configuration Sheltered corridors ensuring safe circulation	 Sources: (Muiruri, 2025; Baena, 2025; Archdaily, n.d.)

The cases illustrate diverse strategies through which architecture responds to scarcity, regional identity, and community participation, offering critical insights into contextual design practices. Through strategies of critical regionalism and scarcity-driven innovation, these projects demonstrate how educational environments can become catalysts for social engagement, resilience, and community identity. Table 1-2 presents a pre-analysis table in which the identity, architectural design characteristics, the image of structure and context of the schools are systematically detailed.

Table 2. Schools examined within the case study framework.

Code	Identity Information	Design Characteristics	Structure + Context
S5	African Flow Location: Soa, Cameroon Year: 2015 Architecture: Urbanitree	Local culture, climate, and materials Local craftsmanship, community participation, empowerment "Ecosystem-based" spatial organization Use of solar panels Low-tech construction approach Mountain space: a place for creativity and introspection Village space: a center for shared rituals with the local community Savanna: a gathering space for play and group interaction Forest space: a transitional area integrated with nature	
			Sources: (Africanflow, n.d.; Urbanitree, n.d.; Exagono, 2025; Archdaily, n.d.; Yapıdergisi, n.d.)
S6	Gando Primary School Location: Gando, Burkina Faso Year: 2001 Architecture: Kéré Architecture	Use of local materials and traditional construction techniques Metal roof form inspired by local architecture Construction with the participation of the local community Precautions against heavy rains and flooding Terraces with platforms designed for landscape views Thermal protection of clay bricks against hot climate conditions Utilization of solar panels and underground water sources Planning for local fruit and vegetable cultivation in the garden Design and construction based on "on-site" criteria	
			Sources: (Kerearchitecture, n.d.; Charles, 2025; Tong, 2023; Archdaily, n.d.)
S7	Makoko Floating School Location: Lagos, Nigeria Year: 2013 Architecture: NLÉ	Inspiration from stilt houses built on the Lagos Lagoon Flood-resistant floating building design Developing alternative building systems and urban water cultures Alternative drainage solution to the waste discharged Photovoltaic panels and rainwater harvesting system Use of local materials Low-tech and sustainable construction techniques Construction with the participation of the local community Triangular A-frame floating structure	
			Sources: (Nleworks, n.d.; Badejo, 2016; Agakhanaward, n.d.; Archello, n.d.; Gaestel, n.d.; Riise & Adeyemi, 2015; Publicdelivery, 2025)
S8	Ruhehe Primary School Location: Ruhengeri, Rwanda Year: 2018 Architecture: Mass Design Group	A practical/learning site for young ADC designers Renovation of the existing school Context-driven design with the community Design of a plaza for community use Labor employed of Local community Use of local materials and construction techniques Use of recycled materials Walls designed with inspiration from nearby volcanic mountains Incorporation of local children's play patterns	
			Sources: (Massdesigngroup, n.d.; Mtamu, 2018; BSA Design Awards, 2019; Archdaily, n.d.)

The selected case studies represent a diverse range of architectural responses to conditions of scarcity, environmental context, and cultural settings. Mubuga Primary School was selected as a case illustrating local fabrication processes, where women participated as local laborers during construction. The school is located amidst rural agricultural lands actively cultivated by the community. Umubano Primary School adapts to topography through terraced platforms situated at different levels, a design strategy that also provides age-specific pedagogical spaces for children. Eco Moyo Education Centre, established in response to limited local resources, extends beyond its educational function to serve as a community-based hub addressing wider socio-economic needs. Nairobi Waldorf School stands out as an organic structure growing among trees, offering an experiential environment that fosters children's pedagogical development through its spatial language. Other cases highlight similar strategies. African Flow School draws inspiration from vernacular traditions and ecosystem-based spatial arrangements, offering children an education rooted in sensory, social, and cultural connections, while also creating communal spaces accessible to the broader public. Gando Primary School, designed by a local architect as his first project, was built in a village without a school, financed through a foundation he established and constructed with the participation of local residents. Makoko Floating School, conceived to enhance urban water cultures, was designed as a floating structure to provide an alternative to stilt-based lagoon dwellings vulnerable to heavy rainfall and flooding. Finally, Ruhehe Primary School, developed under the African Design Centre's "design-build" program, exemplifies applied design education

while also embodying collective participation through the involvement of women and children in its construction.

Building on these varied architectural and socio-cultural contexts, the following section examines the role of institutional actors in shaping the design processes of the selected schools. In Umubano Primary School, the involvement of A Partner in Education (APIE) was limited not to architectural form-making but rather to compliance with the Rwandan national curriculum and pedagogical constraints. In the case of Gando Primary School, the foundation established to raise funds for the school's construction, Bricks for Gando, did not impose architectural design constraints. Instead, the determining factors shaping the design and construction process were the use of local materials, climatic adaptation, and a production capacity rooted in community labor. At Nairobi Waldorf Primary School, the spatial principles of Waldorf pedagogy; such as scale, the use of natural materials, and flexible learning environments, were directly translated into architectural form under the guidance of the Nairobi Waldorf School Trust.

The Eco Moyo and African Flow projects were implemented by various non-governmental organizations. In these cases, institutional constraints were articulated primarily through indirect parameters such as limited budgets, incremental construction processes, and sustainability objectives, while architectural interpretation and flexibility were largely preserved. Ruhehe and Mubuga Primary Schools, developed through the collaboration of MASS Design Group, M2 Foundation, and the African Design Centre, public standards, health and hygiene requirements, and community participation constituted the primary determinants of the design process. Unlike the other cases, Makoko Floating School prioritizes environmental adaptation over formal educational continuity, thereby expanding the definition of school architecture under conditions of scarcity. In the Makoko Floating School project, expectations set by institutions such as UNDP and the Heinrich Böll Stiftung regarding climate adaptation and experimental prototyping generated strong spatial constraints, most notably the requirement for a floating structure. Taken together, these examples demonstrate that architectural production in the African context does not operate under a singular regime of "institutional imposition," but rather emerges within a plural design environment shaped through negotiation among multiple actors and pedagogical, ethical, and structural frameworks.

3.1 Environmental Context

The environmental context constitutes a key factor influencing the examined school projects. The relationship to site and landscape was analyzed as a locality-based design criterion, focusing on how topography, orientation, existing vegetation, and environmental conditions shape architectural form and spatial experience across the case studies. In Mubuga (S1), classrooms were oriented in relation to solar exposure and prevailing wind directions to address insufficient daylight, and outdoor classrooms were integrated into the spatial layout. In Umubano (S2), the necessity of building on a steep slope exceeding 45° led to the distribution of classrooms, courtyards, and open terraces across five distinct platforms, with vegetation strategically incorporated to mitigate soil erosion and landslide risks. In Eco Moyo (S3), buildings were arranged in clustered formations around open spaces and separated by dense vegetation, reinforcing microclimatic buffering.

At Nairobi Waldorf (S4), the school was shaped by existing trees in accordance with Waldorf forest education principles. Drawing on vernacular spatial practices associated with local Maasai communities, classrooms were spatially integrated within the forested landscape, resulting in a dispersed settlement pattern. In African Flow (S5), a transitional "forest" space mediates interior and exterior environments and integrates the school with its natural surroundings, with the overall layout organized around an inner courtyard. In Gando (S6), elevated platforms form terraces oriented toward the landscape, buildings are aligned according to solar orientation, and courtyards are shaded by large deciduous trees.

In Makoko (S7), the building was placed on a platform constructed from recycled plastic barrels as a prototype floating school responding to seasonal flooding conditions. In Ruhehe (S8), the redesigned campus incorporates a central public square for community use, with courtyards featuring paving patterns inspired by local children's games to support play and social interaction. These site-specific spatial configurations were

analyzed within the environmental context criterion, as they directly engage with topography, landscape, and environmental constraints. The spatial and contextual characteristics of the schools are illustrated through site plans and ground-floor plans in Figure 3.

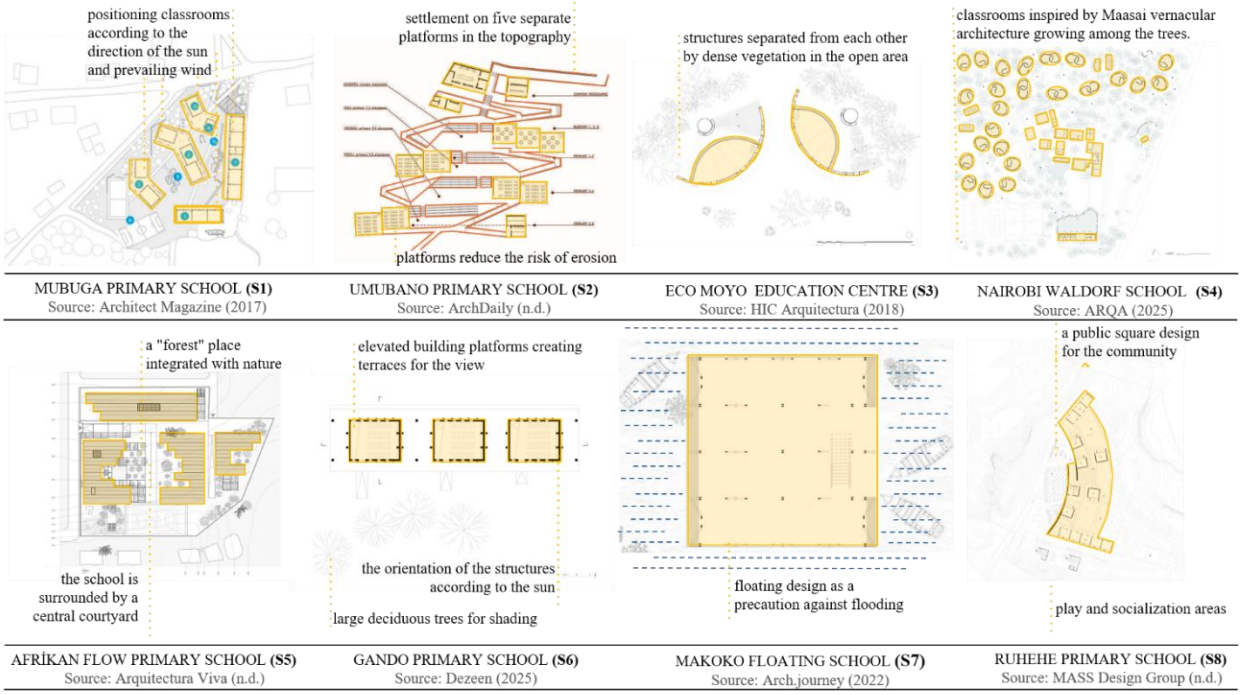


Figure 3. Site or ground floor plans of schools (Authors, 2026).

Environmental context was identified as an influential factor shaping the examined school projects. In Mubuga (S1), climatic data informed design decisions related to orientation and spatial organization, while in Umubano (S2) environmental considerations were less explicitly emphasized; instead, adaptation to steep topography was addressed through platforms and a connecting bridge that improved neighborhood accessibility. Vernacular building traditions were articulated in different ways across the projects: Umubano (S2) employed earth bricks and a rural settlement pattern, Nairobi Waldorf (S4) drew on spatial references associated with Maasai architecture, Gando (S6) maintained continuity with local housing through its metal roof construction, and Makoko (S7), located on a lagoon, reflected the stilt-based urban fabric of its context.

Landscape conditions further informed architectural responses. In Umubano (S2), terraced platforms integrated the school with its surrounding greenery. Eco Moyo (S3) employed timber façades, sisal screens, and stepped concrete floors to respond to environmental conditions. At Nairobi Waldorf (S4), classroom placement respected existing trees, resulting in a dispersed layout within a forested setting. African Flow (S5) was organized around a transitional “forest space,” while Gando (S6) incorporated terraces oriented toward the landscape. In Ruhehe (S8), the form of school walls was designed in reference to the silhouette of nearby volcanoes.

Across several cases, climatic conditions and environmental risks informed broader design strategies. In Gando (S6), flood risk influenced site planning decisions, while Makoko (S7) addressed recurring flooding through the adoption of a floating structure. In both projects, environmental constraints related to drainage and waste management shaped architectural and infrastructural solutions. Taken together, these examples are discussed, within the scope of the analyzed documentation, in relation to place-based design approaches associated with Frampton’s critical regionalism, where local climate, topography, and landscape inform architectural form (Table 3).

Table 3. Environment context in African schools.

		S1	S2	S3	S4	S5	S6	S7	S8
Environmental Context	Solution to Transportation	☒	■	☒	☒	☒	☒	☒	☒
	Reference to Local Architecture	☒	■	☒	■	☒	■	■	☒
	Integration with the Landscape	☒	■	■	■	■	■	☒	■
	Climate Adaptation	■	■	■	■	■	■	■	■
	Solution to Environmental Problems	☒	☒	☒	☒	☒	☒	■	☒

3.2 Climate Sensitivity

Climate sensitivity was analyzed as a locality-based design criterion, focusing on how architectural form, section, and material systems respond to site-specific climatic conditions across the examined cases. Climatic conditions significantly influenced architectural design decisions and the formation of building form in the analyzed schools (Figure 4).

Across several cases, strategies related to natural ventilation and daylighting were employed in response to local climatic conditions. In Mubuga (S1), clerestory windows are introduced to allow fresh air and daylight to enter the classrooms, while narrow vertical windows on the façades enable cross-ventilation in combination with air drawn in through roof openings. Similarly, in Umubano (S2), platforms are created to accommodate the challenging sloped topography, and similarly, roof windows are employed to ensure adequate daylight and natural ventilation within interior spaces. In Eco Moyo (S3), raised roof elements further facilitate natural ventilation. These strategies were coded under climate sensitivity as they directly address thermal comfort and daylight requirements documented for the sites.

In other cases, climate-responsive design is articulated through building form and envelope systems. In Nairobi (S4), double-layered polycarbonate walls filled with soil and compost form “living walls” that provide habitats for insects and worms while contributing to environmental performance. In African Flow (S5), an internal garden is introduced, with natural ventilation provided through this courtyard, and a timber water tower covered with photovoltaic panels is constructed to utilize renewable energy sources. In Gando (S6), wide roof overhangs protect the building from rainfall, while a perforated clay ceiling beneath the metal roof enhances ventilation and thermal comfort. These design decisions were analyzed as climate-sensitive strategies integrating material systems with environmental performance.

To protect the building from flooding, the structure is placed on raised platforms constructed from local stone. In Makoko (S7), the building is designed as a floating system, integrating photovoltaic panels and a rainwater harvesting system into the roof; natural ventilation openings oriented to prevailing wind directions keep the classrooms cool, while thin wooden panels on the exterior provide shading for the learning spaces. In Ruhehe (S8), operable lower window sections allow fresh air to enter the classrooms, polycarbonate skylights provide sufficient natural daylight, and suspended light shelves beneath the ceilings diffuse daylight filtered through the polycarbonate openings, reducing direct solar exposure and glare.

In contexts exposed to climatic risks, climate sensitivity informed broader infrastructural and spatial strategies. To mitigate flood-related risks, buildings were positioned on raised platforms constructed from local stone. In Makoko (S7), the school is designed as a floating system, integrating photovoltaic panels and a rainwater harvesting system into the roof, while natural ventilation openings oriented toward prevailing wind directions and exterior wooden shading panels contribute to thermal comfort. In Ruhehe (S8), operable lower window sections, polycarbonate skylights, and suspended light shelves support natural ventilation and daylight distribution while reducing direct solar exposure and glare. These measures were coded within the climate sensitivity criterion due to their direct engagement with site-specific climatic challenges.

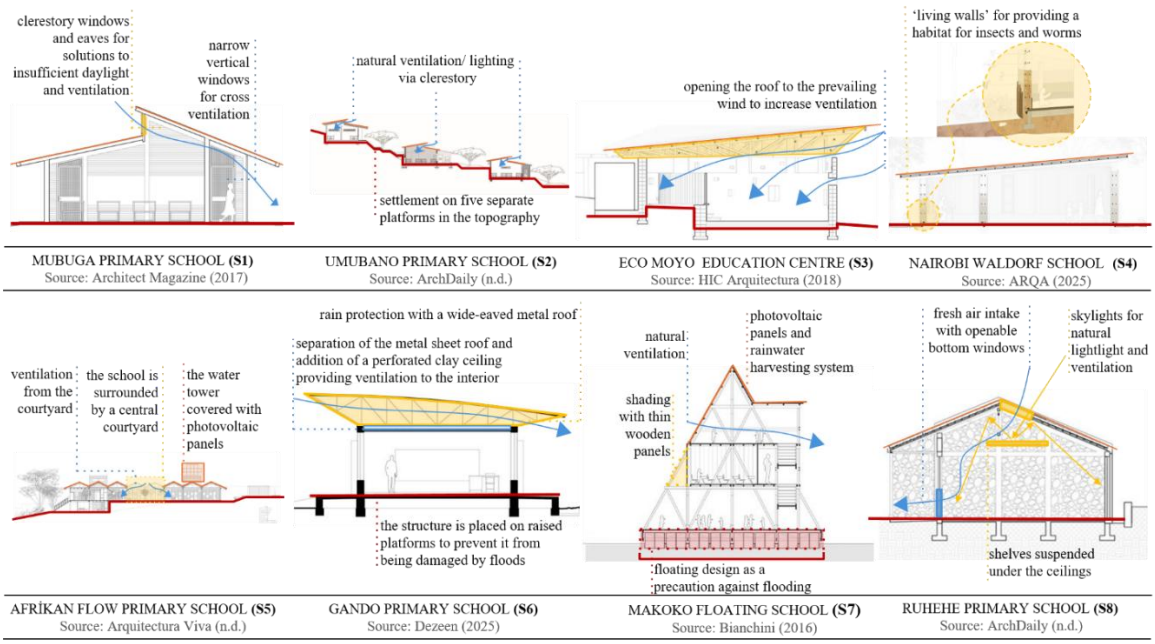


Figure 4. Sections of schools (Authors, 2026).

Across the examined cases, strategies related to climate sensitivity were consistently identified, with an emphasis on natural lighting, ventilation, energy efficiency, and low-maintenance design solutions. In Mubuga (S1), classrooms were oriented toward the sun, clerestory windows were employed, and roof overhangs were added to provide shading. Umubano (S2) utilized single-pitch roofs and clerestory openings to support daylight penetration and airflow. In Eco Moyo (S3), open structural configurations, timber walls, and pergolas were designed to balance daylight access with shaded areas. In Nairobi Waldorf (S4), polycarbonate roofs and wall systems were used to modulate light conditions, while African Flow (S5) combined earthen brick construction with native tree species to control daylight and microclimatic conditions. Gando (S6) oriented courtyards for solar control, introduced voids between metal roofs and clay ceilings to enhance light penetration, and applied shading devices. Ruhehe (S8) incorporated skylights and light shelves to distribute daylight, and Makoko (S7) employed slender timber panels to filter incoming light. In Gando (S6) and Ruhehe (S8), material selection further contributed to thermal insulation and protection against rainfall.

The findings indicate that strategies related to natural ventilation were identified as a recurring component of climate-sensitive design. In Mubuga (S1), classrooms were aligned with prevailing wind directions, semi-open layouts were introduced, and narrow vertical windows supported cross-ventilation. Umubano (S2) incorporated clerestory roof openings, perforated brickwork, and woven doors to facilitate airflow. In Eco Moyo (S3), variations in roof height were designed in response to wind conditions, while Nairobi Waldorf (S4) employed suspended roof structures to enhance ventilation. In other projects, material systems and spatial configurations contributed to passive cooling strategies. African Flow (S5) relied on earthen brick construction and timber elements to support thermal regulation, Gando (S6) integrated perforated clay ceilings beneath metal roofs, Makoko (S7) created openings oriented toward prevailing winds, and Ruhehe (S8) designed window systems to sustain continuous airflow. Where feasible, climate-responsive strategies were complemented by renewable energy use and water management practices. Mubuga (S1) introduced surface water collection pits, Eco Moyo (S3) implemented rainwater harvesting systems, African Flow (S5) and Gando (S6) adopted solar panels, and Makoko (S7) integrated photovoltaic systems alongside waste recycling practices.

Landscape design supported shading, erosion control, and flood mitigation across the examined projects. Mubuga (S1) used vines and vegetation, Gando (S6) planted large-leaved trees for shading, Umubano (S2) integrated vegetation into terraced platforms, and Eco Moyo (S3) employed trees to buffer tropical rainfall. Protection against heavy rainfall was addressed in Eco Moyo (S3) through makuti walls, in Gando (S6) through

wide roof overhangs and raised platforms, and in Makoko (S7) through its experimental floating system. Drainage systems were implemented in Umubano (S2) through retaining walls and in Makoko (S7) through waste filtration and recycling strategies (Table 4). Collectively, these strategies reveal climate-responsive designs consistent with Frampton's critical regionalism, emphasizing sensitivity to environmental and cultural conditions while demonstrating efficient use of natural resources and sustainable materials (Canizaro, 2007).

Table 4. Climate sensitivity in African schools

		S1	S2	S3	S4	S5	S6	S7	S8
Climate Sensitivity	Light and Shading Balance	■	■	■	■	■	■	■	■
	Solution to Ventilation Problems	■	■	■	■	■	■	■	■
	Use of Renewable Energy Sources	■	☒	■	☒	■	■	■	☒
	Landscape-Integrated Design	■	■	■	☒	☒	■	☒	☒
	Solution to Drainage System	☒	■	☒	☒	☒	☒	■	☒
	Solution to Thermal Insulation	☒	☒	■	☒	☒	■	☒	■
	Protection from Rain and Flooding	☒	☒	■	☒	☒	■	■	☒

3.3 Cultural Context Sensitivity

Sensitivity to cultural context was analyzed as a locality-based design criterion, focusing on how social practices, collective use, and cultural references are translated into spatial organization and architectural elements across the examined school projects. In Mubuga (S1), gender-responsive design strategies were implemented through the provision of facilities specifically designated for girls. Community-oriented spatial approaches were documented in several projects. In Eco Moyo (S3), a permaculture farm served both students and local residents. African Flow (S5) incorporated spaces such as the "Village" and the "Savanna" to support ritual practices and play. In Ruhehe (S8), a central square facilitated communal activities, and in Mubuga (S1) landscaped areas accommodated weddings and public gatherings.

Cultural references were further integrated through material and spatial elements. In Ruhehe (S8), play-area floor patterns were inspired by traditional children's games, while in Mubuga (S1) woven door panels reflected local craft practices. At Nairobi Waldorf (S4), spatial organization drew on references associated with Maasai bomas in the arrangement of forest-based classrooms. In African Flow (S5) incorporated vernacular models alongside dedicated music spaces for local instruments. These strategies were analyzed within the cultural context sensitivity criterion, as they articulate relationships between educational spaces and local social practices. Within the scope of the analysis, the projects are discussed in relation to principles associated with critical regionalism, particularly in terms of community engagement and culturally embedded spatial production (Table 5).

Table 5. Cultural context sensitivity in African schools

		S1	S2	S3	S4	S5	S6	S7	S8
Cultural Context Sensitivity	Women-Friendly Design	■	☒	☒	☒	☒	☒	☒	☒
	Design for the Local Community	■	☒	■	☒	■	☒	■	■
	Representation of Cultural Motifs	■	☒	☒	■	■	☒	☒	■

3.4 Local Materials and Construction Techniques

This part of the study focuses on how material selection, sourcing practices, and construction techniques reflect locally available resources and respond to environmental, economic, and technical constraints documented in each context, with particular attention to vernacular building practices, craft traditions, and on-site construction processes. Across all projects, locally available materials and traditional construction techniques were consistently employed, reflecting both material accessibility and established building knowledge within each context. Stone was widely used, primarily due to its durability and availability: Umubano (S2) applied limestone in terraced structures, Eco Moyo (S3) used coral stone blocks plastered with local soil–cement mixes, and Ruhehe (S8) relied on volcanic stone and stone dust in concrete tiles. Timber species were equally prominent, valued for their renewability, workability, and familiarity within local

construction practices. Mubuga (S1) used eucalyptus in playground structures, Eco Moyo (S3) combined timber with sisal and makuti panels, and Nairobi Waldorf (S4) created "living walls" by embedding vegetation within polycarbonate panels. African Flow (S5) incorporated termite-resistant timber species, while Makoko (S7) employed tropical hardwoods and Ruhehe (S8) utilized cypress, bamboo, and bark.

Reed, cane, and straw, materials commonly used in vernacular construction, were applied in ceilings, doors, and partitions in Mubuga (S1), Umubano (S2), and Eco Moyo (S3), supporting lightweight construction and passive climatic performance. Earth- and clay-based materials further illustrate the integration of local techniques and resource efficiency: Umubano (S2) employed stabilized earth blocks, Eco Moyo (S3) used coral stone, Nairobi Waldorf (S4) incorporated soil-filled wall systems, African Flow (S5) applied compressed earth blocks, Gando (S6) relied on clay bricks and adobe, and Ruhehe (S8) used fired clay tiles.

The use of waste and recyclable materials was identified across several cases, reflecting approaches to resource efficiency and material reuse within local construction contexts. Mubuga (S1) reused car springs in playground equipment, Nairobi Waldorf (S4) employed salvaged timber, and Makoko (S7) repurposed oil barrels as building components. These practices are discussed in the analyzed sources in relation to environmental considerations and the efficient use of regionally available materials.

Overall, the findings demonstrate that the school projects studied are grounded in local material traditions while simultaneously addressing sustainability, environmental adaptation, and climatic responsiveness. Material choices were not isolated decisions but integrated with broader strategies—light, ventilation, energy reduction, water management, and landscape design. Collectively, these examples reveal how schools embody critical regionalism by combining cultural sensitivity, climatic responsiveness, and resource-conscious construction, creating educational environments firmly embedded in local contexts (Table 6).

Table 6. Local materials and construction techniques in African schools.

		S1	S2	S3	S4	S5	S6	S7	S8
Local Materials and Construction Techniques	Use of Stone Material	☒	■	■	☒	☒	☒	☒	■
	Use of Timber Material	■	☒	■	■	■	☒	■	■
	Use of Reeds, Cane, and Thatch	■	■	■	☒	☒	☒	☒	☒
	Use of Earth, Brick, Clay, and Adobe	☒	■	■	■	■	■	☒	■
	Use of Waste Materials	■	☒	☒	■	☒	☒	■	☒

3.5 Tectonic Expression

In the African school case studies, tectonic expression is particularly pronounced in Umubano (S2), Eco Moyo (S3), and Nairobi Waldorf (S4), while in other examples it appears more limited. In line with Frampton's (1983) interpretation of critical regionalism, tectonics is understood not solely as structural articulation but as the legibility of the relationship between construction, materiality, and cultural context. In these three schools, tectonic strategies contribute to making construction processes and material logics perceptible to users, particularly students.

Across the cases where tectonic expression is most evident, lightweight and locally grounded structural systems are a defining feature of these schools. Umubano (S2) employs a light steel frame, Eco Moyo (S3) uses a composite of softwood and OSB panels, and Nairobi Waldorf (S4) incorporates reclaimed timber elements. These systems respond to economic limitations and climatic conditions while simultaneously generating tactile and inhabitable environments that shape everyday spatial experience. Roof structures play a significant role in articulating tectonics and environmental performance. The steel-supported reed roof at Umubano (S2), the galvanized steel roof with sisal ceiling at Eco Moyo (S3), and the timber-suspended roof system at Nairobi Waldorf (S4) expose structural spans and construction logic, which are allowing tectonic elements to function as visible and didactic components of the architecture.

Foundation systems are articulated most clearly in Umubano (S2), where stone and cement retaining walls respond to the sloping topography. In Eco Moyo (S3), where concrete slabs and moisture barriers address ground conditions and durability. In contrast, Nairobi Waldorf (S4) places less emphasis on explicit foundation

expression. Wall systems further differentiate tectonic approaches across the cases. At Umubano (S2), stabilized earth bricks, stone, and reed elements are left largely unplastered, reinforcing material honesty and construction legibility. Eco Moyo (S3) employs makuti and sisal panels to create permeable and climatically responsive surfaces, while Nairobi Waldorf (S4) uses polycarbonate wall systems as "living façades," integrating soil, vegetation, light, and biodiversity.

The analysis reveals that, these three cases foreground tectonic expression as a strategy for cultivating a sense of place. Compared to other examples in this study, their stronger tectonic articulation highlights the role of construction as a technical necessity and a cultural and pedagogical medium. In this context, tectonic expressions operate as an experiential and educational tool, enabling students to engage with space through material presence, environmental interaction, and embodied connection to nature (Table 7).

Table 7. Tectonic expression in African schools.

		S1	S2	S3	S4	S5	S6	S7	S8
Tectonic Expression	Use of Lightweight/Local Structural Systems	☒	■	■	■	☒	☒	☒	☒
	Visibility of the Roof Structure	☒	■	■	■	☒	☒	☒	☒
	Visibility of Foundation and Ground Systems	☒	■	■	☒	☒	☒	☒	☒
	Exposure of Wall, Door, and Panel Systems	☒	■	■	■	☒	☒	☒	☒
	Transparency and Porosity	☒	■	■	■	☒	☒	☒	☒

3.6 Resistance to Global Homogeneity

The school projects examined reveal strategies that actively resist architectural homogenization. These strategies are not generic responses but are firmly grounded in local contexts, reflecting site-specific cultural, environmental, and social conditions. In this sense, resistance emerges through architecture that is shaped by locality rather than standardized design approaches.

Nairobi Waldorf (S4), African Flow (S5), and Gando (S6) schools converge in distancing themselves from industrial materials, privileging local resources, and adopting site-specific approaches. These shared strategies operate not as stylistic expressions but as critical practices that align with the principles of critical regionalism (Frampton, 1983) and the conceptual framework of scarcity architecture (Becerra Santacruz, 2010).

At Nairobi Waldorf (S4), the avoidance of concrete and steel, together with the extensive use of recycled and reclaimed materials, constitutes an explicit critique of industrial construction paradigms. The school's location within a forested environment, its organic spatial organization, and its provisional settlement logic further reinforce this position, embedding architecture within ecological and social processes. African Flow (S5), located in Cameroon, resists universalized architectural models by drawing on vernacular African building traditions and earth-based construction practices, thereby strengthening local identity and continuity with indigenous knowledge systems. Similarly, Gando (S6) emphasizes on-site design and construction processes, employing local materials and craftsmanship to maintain coherence between architectural conception and realization.

From a theoretical perspective, these cases exemplify Frampton's (1983) notion of critical regionalism by countering the homogenizing effects of globalization through material specificity, contextual responsiveness, and culturally embedded construction practices. When interpreted through the lens of scarcity architecture (Becerra Santacruz, 2010), the projects further reveal integrated approaches to economic feasibility, ecological responsibility, and social sustainability. Taken together, the findings indicate that these schools function as critical architectural practices that reinforce local identity and collective memory, rather than serving merely as environmentally adaptive solutions (Table 8).

Table 8. Resistance to global homogeneity in African schools.

		S1	S2	S3	S4	S5	S6	S7	S8
Resistance to Global Homogeneity	Limited Use of Industrial Materials	☒	☒	☒	■	■	■	☒	☒
	Preference for Local-Natural Materials	☒	☒	☒	■	■	■	☒	☒
	Site-Specific Design Approach	☒	☒	☒	■	■	■	☒	☒

3.7 Participatory Design and Construction Process

In this study eight African school projects illustrate the transformative role of participatory design and construction as an integral component of architectural practice. An analysis of the table data reveals a set of recurring participatory codes across the cases. These include community involvement, collaboration with local artisans, and the use of local materials. In addition, education and capacity-building processes, as well as engagement with both local and international actors, are evident. User participation in design decisions and contributions to the local economy also emerge as common themes.

Community participation is articulated most clearly in Gando (S6), Ruhehe (S8), Mubuga (S1), and Eco Moyo (S3). In Gando (S6), the involvement of children in stone collection and women in supplying water for brick production embedded construction processes within collective memory and everyday life. Similarly, Ruhehe (S8) incorporated participatory workshops and student involvement, reinforcing the pedagogical dimension of the building process itself. Collaboration with artisans further strengthens participatory practices in several cases. Eco Moyo (S3) demonstrates close cooperation with local stonemasons and carpenters, while African Flow (S5) integrates training programs that enhance local craftsmanship. In Ruhehe (S8) and Gando (S6), carpentry and masonry training initiatives directed toward women expanded social inclusion and skill development.

The use of local materials and on-site production processes constitutes another shared participatory strategy. Clay brick production at Gando (S6), along with traditional construction techniques employed in Umubano (S2) and Mubuga (S1), illustrate how material practices are intertwined with local knowledge and labor. Educational and capacity-building initiatives are particularly pronounced in Ruhehe (S8), where the design–build approach of ADC fellows extends learning beyond formal schooling. At the same time, Eco Moyo (S3) and Gando (S6) demonstrate how long-term collaborations, supported by international partners and foundations, could deepen participatory engagement without undermining local agency. User participation also plays a significant role in shaping spatial outcomes. Nairobi Waldorf (S4) engaged students and teachers, and Ruhehe (S8) integrated pedagogical analyses into spatial organization. Beyond immediate economic benefits, participatory construction processes contributed to longer-term local development in cases such as African Flow (S5), Ruhehe (S8), and Gando (S6), supporting socially sustainable and development-oriented strategies.

Taken together, the findings indicate that participatory design in these school projects operates as a multilayered process, simultaneously enhancing spatial quality, economic resilience, cultural continuity, and pedagogical engagement within local communities (Table 9).

Table 9. Participatory design and construction process in African schools.

		S1	S2	S3	S4	S5	S6	S7	S8
Participatory Design and Construction Process	Community Engagement	■	☒	■	■	☒	■	☒	■
	Collaboration w/Local Labor and Artisans	☒	■	■	☒	■	■	☒	■
	Use of Local Materials / On-Site Production	■	■	■	■	■	■	☒	■
	Education and Capacity Building	☒	☒	☒	☒	■	☒	☒	■
	Local Actors w/International Collaborations	☒	☒	■	☒	☒	■	■	■
	User Participation in the Design Process	☒	☒	☒	■	■	☒	☒	■
	Contribution to the Local Economy	■	☒	■	☒	■	■	☒	■

3.8 Scarcity Strategies

A substantial portion of the African school projects examined are shaped by conditions of scarcity, encompassing economic, material, infrastructural, and social dimensions. Rather than being treated solely as constraints, these conditions generate architectural responses that converge around a set of shared strategies, including adaptation to limited financial resources, inventive responses to material shortages, localized solutions to infrastructural deficiencies, climate-responsive design, and socially oriented interventions. Within this framework, scarcity operates as a productive force that informs both design decisions and construction processes.

Adaptation to economic limitations emerges as the most widespread strategy and is evident in both state-led initiatives, such as Mubuga (S1) and Umubano (S2), and civil-society–driven projects, including Eco Moyo (S3), Gando (S6), and Makoko (S7). Across these cases, low-cost and sustainable construction techniques are employed to maximize available resources. Gando (S6), for example, developed hybrid clay and mud construction systems, while Makoko (S7) demonstrates creative reuse through the incorporation of recycled oil barrels as structural and spatial components.

Material scarcity further prompted innovative practices of recycling and reuse. At Ruhehe (S8), reclaimed building elements and recycled steel were integrated into new construction, while Makoko (S7) repurposed oil barrels to form floating platforms, transforming waste materials into functional architectural solutions. Infrastructural deficiencies were similarly addressed through passive and localized strategies. Umubano (S2) introduced on-site solutions for rainwater drainage and electricity, Eco Moyo (S3) developed sanitation and water management systems, and Gando (S6) relied on natural ventilation and daylighting to reduce dependence on mechanical infrastructure. Climate adaptation constitutes another central dimension of scarcity-driven design. Makoko (S7) responds to recurrent flooding through floating building typologies, Gando (S6) employs hybrid systems suited to extreme climatic conditions, and Nairobi Waldorf (S4) adopts lightweight and permeable structures that facilitate climatic integration. Beyond environmental and technical considerations, social scarcity strategies extend the role of architecture into broader societal realms. Eco Moyo (S3) addresses poverty and unemployment through construction-related employment and training, Umubano (S2) seeks to mitigate educational inequality, and Nairobi Waldorf (S4) emphasizes pedagogical models rooted in community participation.

Overall the findings suggest that scarcity in these school projects functions not merely as an economic or technical limitation but as a conceptual and operational framework that transforms architecture into a tool of resilience—capable of responding simultaneously to social inequality, climatic challenges, and infrastructural constraints (Table 10).

Table 10. Scarcity strategies in African schools

		S1	S2	S3	S4	S5	S6	S7	S8
Scarcity Strategies	Adaptation to Economic Constraints	■	■	■	☒	☒	■	■	■
	Response to Building Material Scarcity	☒	☒	☒	■	☒	■	■	■
	Addressing the Lack of Infrastructure	☒	■	■	☒	☒	■	■	☒
	Adaptation to Climatic/Physical Conditions	☒	☒	☒	■	☒	■	■	☒
	Strategies for Coping with Social Scarcity	☒	■	■	■	☒	☒	☒	☒

The study highlights how African school architecture develops innovative spatial strategies shaped by environmental, cultural, and economic realities. Climate-responsive design, cultural embeddedness, and tectonic expression are complemented by the use of local materials and participatory construction processes that strengthen community ownership and cultural continuity. Scarcity-driven strategies, such as material reuse and modular design, foster resilience and creativity while aligning with critical regionalist principles. Together, these approaches demonstrate that schools function not only as educational facilities but also as catalysts for social cohesion and ecological adaptation (Table 11).

The analysed school cases demonstrate that participatory design operates as a process-oriented and multi-actor production framework, structured differently according to local socio-economic conditions, institutional constraints, and pedagogical agendas. In Gando Primary School, participation was embedded in long-standing rural construction practices, where collective building and maintenance are part of everyday life. Children, women, and local builders were directly involved in material production and construction activities, enabling traditional building knowledge to be combined with low-tech engineering solutions. This process generated transferable construction expertise within the community and supported subsequent educational and cultural initiatives beyond the school itself. In contrast, the Mubuga Primary School project and its scaled continuation in Ruhehe illustrate a more structured participatory model, developed by MASS Design Group and the African Design Centre through a design–build–evaluate framework. Here, participation was not limited to construction

labour but extended to pre-design research, employment strategies, and post-occupancy considerations. Design decisions were informed by site-based observations, including high youth unemployment, leading to the deliberate use of labour-intensive construction techniques that provided paid employment to 110 local workers, with a significant proportion of women and young people receiving vocational training.

Across these cases, professional actors functioned primarily as facilitators and mediators, coordinating between local knowledge, pedagogical objectives, and institutional requirements rather than acting as sole decision-makers. In Mubuga and Ruhehe, the involvement of the Rwandan Ministry of Education introduced clear budgetary and material constraints, which proved critical in ensuring that participatory design strategies remained compatible with national school construction standards and could be replicated at a regional scale. Ruhehe, in particular, represents the scaling of lessons learned in Mubuga, translating a pilot campus into a cost-controlled and repeatable model for public education infrastructure. By contrast, the Makoko Floating School, developed through collaboration between the Makoko/Iwaya waterfront community, UNDP, and NLÉ, responded to extreme climatic risk and forced displacement, but its long-term continuity was undermined by regulatory instability and state-led demolitions. Other cases, such as Eco Moyo Education Centre, Nairobi Waldorf School, and African Flow, further demonstrate how participatory processes were extended to include teachers, students, parents, local craftsmen, and international partners, integrating construction activities with pedagogical participation and skills training. Taken together, these examples show that participatory school design in resource-constrained contexts functions as a context-sensitive production and governance process, shaped by the interaction of communities, professional networks, educational actors, and public institutions rather than by a single, transferable model.

Table 11. Coding process of African schools due to locality-based criteria.

		Mubuga	Umubano	Eco Moyo	Nairobi Waldorf	African flow	Gando	Makoko	Ruhehe
		S1	S2	S3	S4	S5	S6	S7	S8
Environmental Context	Solution to Transportation	☒	■	☒	☒	☒	☒	☒	☒
	Reference to Local Architecture	☒	■	☒	■	☒	■	■	☒
	Integration with the Landscape	☒	■	■	■	■	■	☒	■
	Climate Adaptation	■	■	■	■	■	■	■	■
	Solution to Environmental Problems	☒	☒	☒	☒	☒	☒	■	☒
Climate Sensitivity	Light and Shading Balance	■	■	■	■	■	■	■	■
	Solution to Ventilation Problems	■	■	■	■	■	■	■	■
	Use of Renewable Energy Sopurces	■	☒	■	☒	■	■	■	☒
	Landscape-integrated Design	■	■	■	☒	☒	■	☒	☒
	Solution to Drainage System	☒	■	☒	☒	☒	☒	■	☒
	Solution to Thermal Insulation	☒	☒	■	☒	☒	■	☒	■
	Protection from Rain and Flooding	☒	☒	■	☒	☒	■	■	☒
Cultural Context Sensitivity	Women-friendly Design	■	☒	☒	☒	☒	☒	☒	☒
	Design fort he Local Community	■	☒	■	☒	■	☒	■	■
	Represantation of Cultural Motifs	■	☒	☒	■	■	☒	☒	■
Local Materials and Construction Techniques	Use of Stone Materials	☒	■	■	☒	☒	☒	☒	■
	Use of Timber Materials	■	☒	■	■	■	☒	■	■
	Use of Reeds, Cane and Thatch	■	■	■	☒	☒	☒	☒	☒
	Use of Earth, Brick, Clay and. Adobe	☒	■	■	■	■	■	☒	■
	Use of Waste Materials	■	☒	☒	■	☒	☒	■	☒
Tectonic Expression	Use of Lightweight/Local Structural Systems	☒	■	■	■	☒	☒	☒	☒
	Visibility of the Roof. Structure	☒	■	■	■	☒	☒	☒	☒
	Visibility of Foundation/Ground Systems	☒	■	■	☒	☒	☒	☒	☒
	Exposure of Wall, Door, and Panel Systems	☒	■	■	■	☒	☒	☒	☒
	Transparency and Porosity	☒	■	■	■	☒	☒	☒	☒
Resistance to Global Homogeneity	Limited Use of Industrial Materials	☒	☒	☒	■	■	■	☒	☒
	Reference for. Local-Natural Materials	☒	☒	☒	■	■	■	☒	☒
	Site-Specific Design Approach	☒	☒	☒	■	■	■	☒	☒
Participatory Design and Construction Process	Community Engagement	■	☒	■	■	☒	■	☒	■
	Collaboration w/Local Labor and Artisans	☒	■	■	☒	■	■	☒	■
	Use of Local Materials/On-Site Production	■	■	■	■	■	■	☒	■
	Education and Capacity Building	☒	☒	☒	☒	■	☒	☒	■
	Local Actors w/International Collaborations	☒	☒	■	☒	☒	■	■	■
	User Participation in the Design Process	☒	☒	☒	■	■	☒	☒	■
	Contribution to the Local Economy	■	☒	■	☒	■	■	☒	■
Scarcity Strategies	Adaptation to Economic Constraints	■	■	■	☒	☒	■	■	■
	Response to Building Material Scarcity	☒	☒	☒	■	☒	■	■	■
	Adressing the Lack of Infrastructure	☒	■	■	☒	☒	■	■	☒
	Adaptation to Climatic/Physical Conditions	☒	☒	☒	■	☒	■	■	☒
	Strategies for Coping with Social Scarcity	☒	■	■	■	☒	☒	☒	☒

4.0 CONCLUSIONS

This study demonstrates that contemporary school projects in Africa position architectural design not merely as a response to scarcity but as a medium for reinforcing local identity and community agency. Framed within the theoretical lenses of critical regionalism and the architecture of scarcity, the analysis shows that architecture functions beyond technical solutions, operating as a spatial, social, and cultural intervention. Climate-responsive strategies, the use of local materials and traditional building techniques, and participatory construction processes produce environments that are sustainable, accessible, and culturally embedded. In this sense, schools emerge not as passive containers for education but as active instruments that foster participation, resilience, and cultural reproduction. Climatic conditions shape spatial organization and material choices, while participatory processes extend from construction to decision-making and post-occupancy evaluation. Such practices transform communities from passive recipients into active agents of spatial production, addressing issues of poverty, exclusion, and infrastructural insufficiency. School design, therefore, intersects with questions of social justice and humanitarian responsibility, creating inclusive and community-oriented spaces. Reconceived as multifunctional socio-spatial nodes, schools operate simultaneously as sites of learning, gathering, economic activity, and cultural expression. They become laboratories where architectural experimentation intersects with pedagogical reform and empowerment. Scarcity, rather than a deficit, is reframed as a catalyst for creativity, resilience, and solidarity. The intersection of scarcity and critical regionalism provides a robust framework for rethinking architecture under constraint. African school projects demonstrate the capacity of architecture to resist homogenization, embrace ecological imperatives, and empower communities through context-sensitive design. These insights contribute not only to African architectural discourse but also to global debates on sustainability, equity, and resilience. At a time defined by climate crisis and inequality, the projects analyzed highlight the need to reconceptualize architecture as a socio-spatial practice.

Comparative evaluations of the effects of environmental qualities on learning, play, and enjoyment, as well as learning outcomes and pedagogical performance data, in relation to homogeneous modern school models and scarcity-sensitive school designs are outside the scope of this research but may shed light on future studies. Furthermore, the potential of school design and construction processes to function as knowledge transfer mechanisms for teachers, students, and local communities in situations intersecting with ecotourism constitutes an important direction for future research. This article, within these limitations, offers a conceptual framework upon which pedagogically focused and interdisciplinary research on educational environments can be developed. Also, this study serves as a model for cross-cultural investigations into how locality shapes educational architecture in different geographies, opening avenues for potential comparative research at a conceptual level in other resource-scarce contexts, including Asia and Latin America. Any regional application will require context-specific theoretical frameworks and empirical research sensitive to local socio-cultural, climatic, and institutional conditions.

5.0 REFERENCES

Adeyemo, A., & Amole, B. (2023). Understanding the multiple architectural modernities in colonial and postindependence Nigeria. *Curator: The Museum Journal*. https://doi.org/10.1111/cura.12587

African Flow. (n.d.). *An innovative and sustainable school in Cameroon*. Retrieved August 22, 2025, from https://www.africanflow.org/africanflow_eng/

Aga Khan Award for Architecture. (2013). *Umubano Primary School project brief.*

Aga Khan Award for Architecture. (n.d.). *Makoko Floating School*. Retrieved August 22, 2025, fromhttps://the.akdn/en/how-we-work/our-agencies/aga-khan-trust-culture/akaa/makoko-floating-school

Agboola, O. P., & Zango, M. S. (2025). Development of traditional architecture in Nigeria: A case study of Hausa house form. *SSRN Electronic Journal*. http://dx.doi.org/10.2139/ssrn.5118943

ArchDaily. (n.d.). *African Flow Kindergarten / Urbanitree*. Retrieved August 22, 2025, from https://www.archdaily.com/1031917/african-flow-kindergarten-urbanitree

ArchDaily. (n.d.). *Eco Moyo Education Centre*. Retrieved August 22, 2025, from https://www.archdaily.com/871408/eco-moyo-education-centre-the-scarcity-and-creativity-studio

Archello. (n.d.). *Makoko Floating School*. Retrieved August 22, 2025, from https://archello.com/pt/project/makoko-floating-school

Architect Magazine. (n.d.). *Mubuga Primary School*. Retrieved August 22, 2025, from https://www.architectmagazine.com/project-gallery/the-mubuga-primary-school

Azouqah, H., Alomar, N., Kaadan, L., Sonbul, M., Abdulaziz, H., & Labib, W. A. (2021). Sustainable local materials: A study of adobe bricks in Saudi Arabia. *Materials Science Forum*, *1047*, 163–173. https://doi.org/10.4028/www.scientific.net/MSF.1047.163

Bach, D. (2015). *Regionalism in Africa: Genealogies, institutions and trans-state networks*. Routledge. https://doi.org/10.4324/9781315733180

Baena, C. G. (2025). *Teaching connected to the environment: Waldorf School in Nairobi by Urko Sanchez Architects*. Retrieved August 22, 2025, from https://www.metalocus.es/en/news/teaching-connected-environment-waldorf-school-nairobi-urko-sanchez-architects

Becerra Santacruz, A. (2010). *Architecture of scarcity* (Doctoral dissertation, University of Sheffield). White Rose eTheses Online. https://etheses.whiterose.ac.uk/14975/

Badejo, E. (2016). *Why Makoko floating school collapsed, by architect*. Retrieved August 22, 2025, from https://guardian.ng/property/why-makoko-floating-school-collapsed-by-architect/

Benimana, C. (2018). Creating design leaders: The African Design Centre. In L. Abendroth & B. Bell (Eds.), *Public interest design education guidebook* (pp. 135–140). Routledge.

Boylston, S. (2019). *Designing with society.* Routledge.

BSA Design Awards. (2019). *Ruhehe Primary School*. Retrieved August 22, 2025, from http://designawards.architects.org/projects/education-facilities-design/ruhehe-primary-school

Canizaro, V. B. (2007). *Architectural regionalism: Collected writings on place, identity, modernity, and tradition*. Princeton Architectural Press.

Charles, S. (2025). *Diébédo Francis Kéré's Gando Primary School was the most significant building of 2001*. Retrieved August 22, 2025, from https://www.dezeen.com/2025/01/07/francis-kere-gando-primary-school-25-buildings/

Charlesworth, E. (2006). *Architects without frontiers.* Routledge.

Charlesworth, E. (2014). *Humanitarian architecture: 15 stories of architects working after disaster.* Routledge.

Codjoe, E., & Kiconco, J. (2023). Reflections on the impact of tropical modernism on African primary schools. *Docomomo Journal*, *69*. https://doi.org/10.52200/docomomo.69.06

Demissie, F. (Ed.). (2012). *Colonial architecture and urbanism in Africa: Intertwined and contested histories*. Routledge. https://doi.org/10.4324/9781315259932

De Raedt, K. (2014). Between 'true believers' and operational experts: UNESCO architects and school building in post-colonial Africa. *The Journal of Architecture*, *19*, 19–42. https://doi.org/10.1080/13602365.2014.881905

Exagono. (2025). *African Flow by Urbanitree: An African architecture inspired by ancestral forms and projected towards an autonomous and sustainable future*. Retrieved August 22, 2025, from https://exagono.es/en/african-flow-by-urbanitree-an-african-architecture-inspired-by-ancestral-forms-and-projected-towards-an-autonomous-and-sustainable-future/

Folkers, A. S. (2011). *Modern architecture in Africa: Critical reflections on architectural practice in Burkina Faso, Tanzania and Ethiopia (1984–1999)* (Doctoral dissertation, Delft University of Technology). SUN.

Frampton, K. (1983). Towards a critical regionalism: Six points for an architecture of resistance. In H. Foster (Ed.), *The anti-aesthetic: Essays on postmodern culture* (pp. 16–30). Bay Press.

Fridah, M. (2002). *Sampling in research*. Retrieved from https://erepository.uonbi.ac.ke/bitstream/handle/11295/54895/mugo02sampling.pdf

Gaestel, A. (n.d.). *Things fall apart*. Retrieved August 22, 2025, from https://magazine.atavist.com/2018/things-fall-apart-makoko-floating-school

Golden, E. M. (2017). *Building from tradition: Local materials and methods in contemporary architecture*. Routledge.

Idem, R., Zielonko-Jung, K., & Karpińska, A. (2022). Vernacular and low-tech technologies in humanitarian architecture on the example of Senegal. *Architectus*, *(70)*, 77–89. https://doi.org/10.37190/arc220207

Jackson, I., Harrison, E., Tenzon, M., Woudstra, R., & Tunstall, C. (2025). *Architecture, empire, and trade: The United Africa Company*. Bloomsbury Visual Arts. https://doi.org/10.5040/9781350411340

Kéré Architecture. (n.d.). *Gando Primary School*. Retrieved August 21, 2025, from https://www.kerearchitecture.com/work/building/gando-primary-school-3

Kéré, D. F. (2019). Participation is not just a romantic idea. *Faszination Forschung*, *23*, 48–59. (Interview by T. Edelmann)

Künzler, D. (2022). Social policies driven by labour scarcity: Colonial social policies in the concession economies of the United Nations subregion Middle Africa and their legacy. *Global Political Economy*, *1*(2), 238–256. https://doi.org/10.1332/ZVMH2890

Lamzah, A. (2025). Vernacular architecture: (Re)visiting the concept. *Materials Research Proceedings*, *47*, 1–5. https://doi.org/10.21741/9781644903391-1

Lepik, A. (2010). *Small scale, big change: New architectures of social engagement*. Museum of Modern Art. https://www.moma.org/calendar/exhibitions/1061

Lervik, K. T., & Waitz, A. M. (2022). *Techno-economic analysis of rural microgrid at Eco Moyo Education Centre in Kenya* (Master's thesis, Norwegian University of Science and Technology). NTNU Open. https://hdl.handle.net/11250/3024266

Livsey, T. (2014). Suitable lodgings for students: Modern space, colonial development and decolonization in Nigeria. *Urban History*, *41*, 664–685. https://doi.org/10.1017/S0963926813001065

Longair, S. M. (2016). Visions of the global: The classical and the eclectic in colonial East African architecture. *Les Cahiers d'Afrique de l'Est*, 51, 161-178. https://doi.org/10.4000/eastafrica.327

Louw, M. P. (2021). *The search for hybrid tectonics in contemporary African architecture: Encounters between the global and the local* (Doctoral dissertation, University of Cape Town). Faculty of Engineering and the Built Environment, School of Architecture, Planning and Geomatics. https://hdl.handle.net/11427/35893

Ma, Y., Zou, G., Siu, K. W. M., & Wong, Y. L. (2019). Social-architectural design of community-based embedded comprehensive elderly centers in China: Design content and process. In K. W. M. Siu & Y. L. Wong (Eds.), *Practice and progress in social design and sustainability* (ch. 5). IGI Global. https://doi.org/10.4018/978-1-5225-4183-7.ch005

Martynenko, A., & Kudriashova, I. (2025). Architecture of identity in the era of globalization: Regionalism, bioclimatic strategies, and the reinterpretation of traditional architecture. *Current Problems of Architecture and Urban Planning*, *(73)*, 92–109. https://doi.org/10.32347/2077-3455.2025.73.92-109

MASS Design Group. (n.d.). *Mubuga Primary School*. Retrieved August 22, 2025, from https://massdesigngroup.org/index.php/work/design/mubuga-primary-school

MASS Design Group. (n.d.). *Ruhehe Primary School, Musanze District, Rwanda*. Retrieved August 22, 2025, from https://massdesigngroup.org/work/design/ruhehe-primary-school

MASS Design Group. (n.d.). *Umubano Primary School*. Retrieved August 22, 2025, from https://massdesigngroup.org/index.php/work/design/umubano-primary-school

Mileto, C., Vegas, F., & García-Soriano, L. (2024). *Burkina Faso: Architecture, culture et coopération*. Editorial Universitat Politècnica de València.

Mkandawire, T. (2001). Thinking about developmental states in Africa. *Cambridge Journal of Economics*, *25*, 289–314. https://doi.org/10.1093/cje/25.3.289

Moradi, A. (2008). Confronting colonial legacies: Lessons from human development in Ghana and Kenya, 1880–2000. *Journal of International Development*, *20*, 1107–1121. https://doi.org/10.1002/jid.1514

Mtamu, K. (2018). *Ruhehe School / African Design Centre*. Retrieved August 22, 2025, from https://www.archidatum.com/projects/ruhehe-school-african-design-centre/

Muiruri, P. (2025). *Outside the box: Waldorf School Campus in Nairobi, Kenya, by Urko Sanchez Architects*. Retrieved August 22, 2025, from https://www.architectural-review.com/buildings/outside-the-box-waldorf-school-campus-in-nairobi-kenya-by-urko-sanchez-architects

Müller-Friedman, F., & Friedman, J. (2023). Modernism on the margins: A genealogy of Namibia's (post-)apartheid spaces. *Environment and Planning C: Politics and Space*, *41*(4), 735–751. https://doi.org/10.1177/23996544231152686

Myers, G. (2011). *African cities: Alternative visions of urban theory and practice*. Zed Books.

Njoh, A. J. (2016). *Planning power: Town planning and social control in colonial Africa*. UCL Press.

Nguluma, H. M. (2008). The role of *mafundi* in housing construction in informal settlements in Dar es Salaam. *Journal of Building and Land Development*, *13*(2), 84–93. https://doi.org/10.4314/jbld.v13i2.41411

NLE Works. (n.d.). *Makoko Floating School*. Retrieved August 22, 2025, from https://nleworks.com/case/makoko-floating-school-2/

Ocheni, S. I., & Nwankwo, B. C. (2012). Analysis of colonialism and its impact in Africa. *Cross-Cultural Communication*, *8*, 46–54. https://doi.org/10.3968/j.ccc.1923670020120803.1189

Okeke, F. O., Chukwuali, B. C., & Idoko, A. E. (2019). Environmentally responsive design: A study of Makoko Floating School building. *International Journal of Development and Sustainability*, *8*(8), 476–487. https://isdsnet.com/ijds-v8n8-02.pdf

Olatayo, S. (2025). Conflict, Economic Development and Peacebuilding in the African Context. *African Journal of Stability and Development (AJSD)*, *17*(2), 1262–1285. https://doi.org/10.53982/ajsd.2025.1702.25-j

Olweny, M. (2018). Introducing sustainability into an architectural curriculum in East Africa. *International Journal of Sustainability in Higher Education, 19*(6), 1131–1152. https://doi.org/10.1108/IJSHE-02-2018-0039

Özkan, S. (1985). Introduction–regionalism within modernism. In R. Powell (Ed.), *Regionalism in architecture* (pp. 8–16). Concept Media / The Aga Khan Award for Architecture.

Pandey, D.,& Tyagi, T. (2022). Critical regionalism in architecture with respect to the Jaipur City. *International Journal for Research in Applied Science and Engineering Technology, 10(7), 3971-3978.* https://doi.org/10.22214/ijraset.2022.45877

Patton, M. Q. (1990). *Qualitative evaluation and research methods* (2nd ed.). Sage Publications.

Poveda Burgos, Y. (2025). Governance and participatory co-construction processes: Case Cerro San Eduardo in Guayaquil. *ESTOA*, *14*(27). https://doi.org/10.18537/est.v014.n027.a07

Rapoport, A. (1969). *House form and culture*. Prentice-Hall.

Ren, X. (2016). Socially engaged architecture in a Chinese rural village: Xihe Village Community Centre, 2014. *arq: Architectural Research Quarterly*, *20*, 119–130. https://doi.org/10.1017/S1359135516000282

Re-thinking the Future. (n.d.). *Eco Moyo Education Centre*. Retrieved August 22, 2025, from https://www.re-thinkingthefuture.com/educational/3050-eco-moyo-education-centre-by-the-scarcity-and-creativity/

Riise, J., & Adeyemi, K. (2015). Case study: Makoko Floating School. *Current Opinion in Environmental Sustainability*, *13*, 58–60. https://doi.org/10.1016/j.cosust.2015.02.002

Rodriguez, J. (2021). *Take advantage of local resources: Eco Moyo Education Centre*. Retrieved August 22, 2025, from https://www.metalocus.es/en/news/take-advantage-local-resources-eco-moyo-education-centre-kindergarten

Salama, A. M. (2015). *Spatial design education: New directions for pedagogy in architecture and beyond*. Routledge. https://doi.org/10.4324/9781315610276

Sore, S. O., Messan, A., Prud'Homme, E., Escadeillas, G., & Tsobnang, F. (2018). Stabilization of compressed earth blocks (CEBs) by geopolymer binder based on local materials from Burkina Faso. *Construction and Building Materials*, *165*, 333–345. https://doi.org/10.1016/j.conbuildmat.2018.01.051

Sun,L. (2024). Study on the cultural impact of local materials in regional architectural design. *Communications in Humanities Research,* 45, 9-14. https://doi.org/10.54254/2753-7064/45/20240080

Till, J. (2014). Scarcity and agency. *Journal of Architectural Education*, 68(1), 9–11. https://doi.org/10.1080/10464883.2014.864894

Till, J., Goodbun, J., Klein, M., & Rumpfhuber, A. (2014). *The design of scarcity*. Strelka Press.

Till, J. (2012). Scarcity contra Austerity, *Places Journal.* https://doi.org/10.22269/121008

Tong, W. (2023). Building daylight simulation analysis based on Ladybug + Honeybee parametric approach: A case study of Gando Primary School. *Journal of Architectural Research and Development*, *7*(4), 7–14. https://doi.org/10.26689/jard.v7i4.4900

Uduku, O. (2006). Modernist architecture and "the tropical" in West Africa: The tropical architecture movement in West Africa, 1948–1970. *Habitat International*, *30*(3), 396–411. https://doi.org/10.1016/j.habitatint.2004.11.001

Uduku, N. (2018). School design in Africa: The background. In *Learning spaces in Africa: Critical histories to 21st century challenges and change* (pp. 26–51). Routledge.

UNICEF. (2021). *Primary education*. UNICEF Data. Retrieved January 24, 2026, from https://data.unicef.org/topic/education/primary-education/

Urbanitree. (n.d.). *African Flow*. Retrieved August 22, 2025, from https://urbanitree.com/project/african-flow/

Yıldız Kuyrukçu, E., & Özkan, H. (2023). Eleştirel bölgeselcilik kapsamında Ağa Han Mimarlık Ödüllerinin analizi. *PLANARCH – Design and Planning Research*, *7*(1), 19–33. https://doi.org/10.5152/Planarch.2023.23123

Veta, O. D. (2024). Exploring participatory approach to community development projects in Africa: Toward an empowerment-participatory approach for sustainable development. *Journal of Social Work*, *25*(3), 301–317. https://doi.org/10.1177/14680173241283396

Figure References

Figure 1. Wikipedia contributors. (n.d.). *Map of Africa* [Map]. Wikipedia. Retrieved January 20, 2026, from https://tr.wikipedia.org/wiki/Afrika

Table 1.

S1. MASS Design Group. (n.d.). Mubuga Primary School. Retrieved August 22, 2025, from https://massdesigngroup.org/index.php/work/design/mubuga-primary-school

S2. ArchDaily. (n.d.). Umubano Primary School. Retrieved August 22, 2025, from https://www.archdaily.com/372709/umubano-primary-school-mass-design-group

S3. Archidatum. (2017). Eco Moyo Education Centre. Retrieved August 22, 2025, from https://www.archidatum.com/projects/eco-moyo-education-centre-the-scarcity-and-creativity-studio/

S4. ArchDaily. (n.d.). *Nairobi Waldorf School*. Retrieved August 22, 2025, from https://www.archdaily.com/1025737/nairobi-waldorf-school-urko-sanchez-architects

Table 2.

S5. Yapı Dergisi. (n.d.). African Flow Okulu. Retrieved August 22, 2025, from https://yapidergisi.com/african-flow-okulu/

S6. ArchDaily. (n.d.). Gando Primary School / Kéré Architecture. Retrieved August 22, 2025, from https://www.archdaily.com/785955/primary-school-in-gando-kere-architecture

S7. Public Delivery. (2025). *Nigeria's Makoko Floating School: Everything you need to know*. Retrieved August 22, 2025, from https://publicdelivery.org/makoko-floating-school/

S8. ArchDaily. (n.d.). *Ruhehe Primary School / MASS Design Group*. Retrieved August 22, 2025, from https://www.archdaily.com/937803/ruhehe-primary-school-mass-design-group

Figure 3.

S1. Architect Magazine. (2017). *The Mubuga Primary School*. Retrieved January 21, 2026, from https://www.architectmagazine.com/project-gallery/the-mubuga-primary-school_o

S2. ArchDaily. (n.d.). *Umubano Primary School*. Retrieved January 21, 2026, from https://www.archdaily.com/372709/umubano-primary-school-mass-design-group

S3. HIC Arquitectura. (2018). *The scarcity and creativity studio and students' Eco Moyo Education Centre*. Retrieved January 21, 2026, from https://hicarquitectura.com/2018/02/the-scarcity-and-creativity-studio-and-students-eco-moyo-education-centre/

S4. ARQA. (2025). Nairobi Waldorf School. Retrieved January 21, 2026, from https://arqa.com/en/architecture/nairobi-waldorf-school.html

S5. Arquitectura Viva. (n.d.). African Flow kindergarten in Soa. Retrieved January 21, 2026, from https://arquitecturaviva.com/works/escuela-infantil-african-flow

S6. Dezeen. (2025). *Diébédo Francis Kéré's Gando Primary School was the most significant building of 2001*. Retrieved January 21, 2026, from https://www.dezeen.com/2025/01/07/francis-kere-gando-primary-school-25-buildings/

S7. Arch.journey. (2022). *Makoko Floating School* [Instagram post]. Retrieved January 21, 2026, from https://www.instagram.com/p/CdvxsU8OY7q/

S8. MASS Design Group. (n.d.). *Ruhehe Primary School*. Retrieved January 21, 2026, from https://modelofarchitecture.org/projects/ruhehe-primary-school

Figure 4.

S1. Architect Magazine. (2017). *The Mubuga Primary School*. Retrieved January 21, 2026, from https://www.architectmagazine.com/project-gallery/the-mubuga-primary-school_o

S2. ArchDaily. (n.d.). *Umubano Primary School*. Retrieved January 21, 2026, from https://www.archdaily.com/372709/umubano-primary-school-mass-design-group

S3. HIC Arquitectura. (2018). *The scarcity and creativity studio and students' Eco Moyo Education Centre*. Retrieved January 21, 2026, from https://hicarquitectura.com/2018/02/the-scarcity-and-creativity-studio-and-students-eco-moyo-education-centre/

S4. ARQA. (2025). *Nairobi Waldorf School*. Retrieved January 21, 2026, from https://arqa.com/en/architecture/nairobi-waldorf-school.html

S5. Arquitectura Viva. (n.d.). *African Flow kindergarten in Soa*. Retrieved January 21, 2026, from https://arquitecturaviva.com/works/escuela-infantil-african-flow

S6. Dezeen. (2025). *Diébédo Francis Kéré's Gando Primary School was the most significant building of 2001*. Retrieved January 21, 2026, from https://www.dezeen.com/2025/01/07/francis-kere-gando-primary-school-25-buildings/

S7. Bianchini, R. (2016). *Venice Architecture Biennale 2016: The Makoko Floating School II by Kunlé Adeyemi – NLÉ*. Retrieved January 21, 2026, from https://www.inexhibit.com/case-studies/makoko-floating-school-ii-by-kunle-adeyemi-nle/

S8. ArchDaily. (n.d.). *Ruhehe Primary School / Model of Architecture Serving Society (MASS)*. Retrieved January 21, 2026, from https://www.archdaily.com/937803/ruhehe-primary-school-mass-design-group