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The Frugality-Failure Paradox: Innovation, Resource Constraints, and the Governance of Construction in Developing Economies

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Abstract: Developing economies face a dual challenge in the construction sector: the persistent failure of buildings resulting in catastrophic collapses, and the simultaneous emergence of frugal innovations that demonstrate remarkable ingenuity under resource constraints. This article examines these apparently contradictory phenomena, arguing that both building failure and frugal innovation arise from the same underlying conditions—resource scarcity, weak institutional frameworks, and the adaptive responses of actors operating within constrained environments. Drawing on evidence from Nigeria's building industry and case studies of frugal innovations from across the developing world, the analysis develops an integrated framework for understanding how resource constraints shape both the failures and the successes of construction in developing economies. The article identifies corruption, inadequate regulation, unqualified practitioners, and poor maintenance culture as primary causes of building failure, while documenting how frugal innovations in housing, infrastructure, and related sectors demonstrate alternative pathways to meeting construction needs. The central argument is that addressing building failure requires not only technical solutions but also institutional reforms that create enabling environments for frugal innovation while strengthening accountability mechanisms. The article proposes a governance framework that integrates regulatory enforcement, professional standards, and support for grassroots innovation, concluding that sustainable construction in developing economies depends on aligning these often-competing imperatives.

Keywords: building failure, frugal innovation, construction governance, developing economies, Nigeria, regulatory frameworks, sustainable construction

1. Introduction

The construction industry occupies a paradoxical position in the economies of developing nations. On one hand, it represents a critical engine of economic growth, providing employment, stimulating demand for materials and services, and creating the physical infrastructure upon which all other economic activities depend. On the other hand, it is frequently characterized by inefficiency, corruption, and catastrophic failures that impose enormous costs on society—not only in economic terms but also in loss of life and destruction of livelihoods.

Nowhere is this paradox more visible than in Nigeria, where the proliferation of building collapses has claimed hundreds of lives over the past decade and where the quality of construction remains a persistent concern (Akims & Akims, 2022). Yet even as these failures continue, Nigerian entrepreneurs and their counterparts across the developing world have demonstrated remarkable capacity for innovation under constraint—developing frugal solutions that provide housing, infrastructure, and services to populations that conventional approaches have failed to reach (Velananda et al., 2022).

This article examines this apparent contradiction, arguing that building failure and frugal innovation represent two

sides of the same coin. Both arise from conditions of resource scarcity, weak institutional frameworks, and the adaptive responses of actors seeking to meet needs within constrained environments. Understanding this common origin is essential for developing effective responses to both phenomena.

The argument proceeds in four main parts. Section 2 examines the phenomenon of building failure in Nigeria, identifying its causes and consequences. Section 3 examines frugal innovation, documenting case studies from across the developing world and identifying the principles that underlie successful innovations. Section 4 synthesizes these analyses, developing an integrated framework for understanding how resource constraints shape outcomes in the construction sector. Section 5 discusses implications for governance and policy, proposing reforms that address both the causes of failure and the conditions that enable innovation.

The central thesis is that sustainable construction in developing economies requires governance frameworks that simultaneously strengthen accountability and create space for innovation. Regulatory enforcement must be improved to prevent the corruption, negligence, and incompetence that lead to building failure. At the same time, the creative capacity demonstrated by frugal innovators must be recognized and supported, not suppressed by rigid regulations designed for different contexts. The challenge is to align these imperatives—to create governance systems that ensure safety and quality while enabling the flexibility and resourcefulness that characterize successful innovation.

2. Building Failure in Nigeria: Causes and Consequences

2.1 The Scale of the Problem

The statistics are sobering. Between 2013 and 2021, Nigeria experienced at least 83 documented cases of building collapse, resulting in more than 305 fatalities and at least 449 injuries (Akims & Akims, 2022). These figures almost certainly understate the true scale of the problem, as many incidents in rural areas or informal settlements go unreported. The concentration of collapses in Lagos State—which accounted for 50 of the documented cases—reflects both the intensity of construction activity in Nigeria's commercial capital and the regulatory challenges that accompany rapid urbanization.

The human cost of these failures is difficult to overstate. Each collapse represents not only the immediate loss of life but also the destruction of homes, businesses, and community infrastructure that families and neighborhoods depend upon. The psychological trauma experienced by survivors and witnesses compounds the material losses. And the economic costs—including medical expenses, lost productivity, and the need to

rebuild—impose burdens that extend far beyond the immediate site of collapse.

2.2 Categorizing Failure

Building failure encompasses a range of phenomena, from minor defects that impair function to catastrophic collapses that destroy structures entirely. Akims and Akims (2022) distinguish between structural failures, which involve loss of strength or stability, and performance failures, which involve inadequate fulfillment of intended functions. Collapse represents the most extreme form of structural failure, occurring when a building can no longer support the loads imposed upon it.

The causes of failure are similarly diverse. Some failures result from errors in design—inadequate assessment of loads, calculation mistakes, or poor detailing of critical connections. Others result from construction defects—use of substandard materials, poor workmanship, or failure to follow specifications. Still others result from external factors—foundation failures due to inadequate site investigation, damage from flooding or other natural events, or deterioration due to lack of maintenance.

Understanding the relative contribution of these factors is essential for developing effective responses. Research on Nigerian building failures suggests that structural defects and use of substandard materials are the leading causes, with design errors and construction defects playing significant roles (Akims & Akims, 2022). The predominance of these causes—both of which are preventable through adequate regulation and professional practice—points to systemic failures in the governance of construction.

2.3 The Role of Corruption

Corruption occupies a central position in explanations of building failure in Nigeria. The term encompasses a range of practices—bribery, fraud, embezzlement, nepotism—that undermine the integrity of construction processes and the effectiveness of regulatory oversight. In the construction sector, corruption manifests in multiple ways: contractors bribing officials to obtain permits or overlook violations; inspectors accepting payments to certify substandard work; procurement officers manipulating contracts to favor connected suppliers; and developers cutting corners to maximize profits while evading accountability.

The consequences of corruption are manifold. Substandard materials may be substituted for specified materials, reducing structural integrity while increasing contractor profits. Unqualified personnel may be hired at lower wages, sacrificing competence for cost savings. Inspections may be waived or falsified, allowing defects to go undetected until they manifest as failures. And enforcement actions may be neutralized through bribery, eliminating the deterrent effect that should discourage negligent practices.

Addressing corruption requires not only stronger enforcement but also institutional reforms that reduce opportunities for corrupt behavior and increase the likelihood of detection and punishment. Transparency in procurement, competitive bidding processes, independent oversight, and severe penalties for violations are all essential components of an effective anti-corruption strategy.

2.4 Regulatory Failures

The regulatory framework governing construction in Nigeria is comprehensive on paper but weak in practice. The Nigerian National Building Code provides detailed requirements for design, construction, and maintenance of buildings. However, enforcement of these requirements is inconsistent and often ineffective.

Several factors contribute to regulatory failure. Regulatory agencies may lack the resources—personnel, equipment, funding—to carry out their responsibilities effectively. Political interference may shield powerful actors from accountability. Coordination among agencies with overlapping jurisdictions may be poor, creating gaps in coverage and opportunities for regulatory arbitrage. And the sheer scale of construction activity, particularly in rapidly growing cities, may overwhelm the capacity of regulators to monitor compliance.

The consequences of regulatory failure extend beyond the immediate risk of collapse. When builders perceive that violations will go unpunished, the incentive to comply with regulations diminishes. When the public perceives that regulators are ineffective or corrupt,

confidence in the safety of buildings erodes. And when failures occur despite the existence of regulations, the legitimacy of the entire regulatory system is called into question.

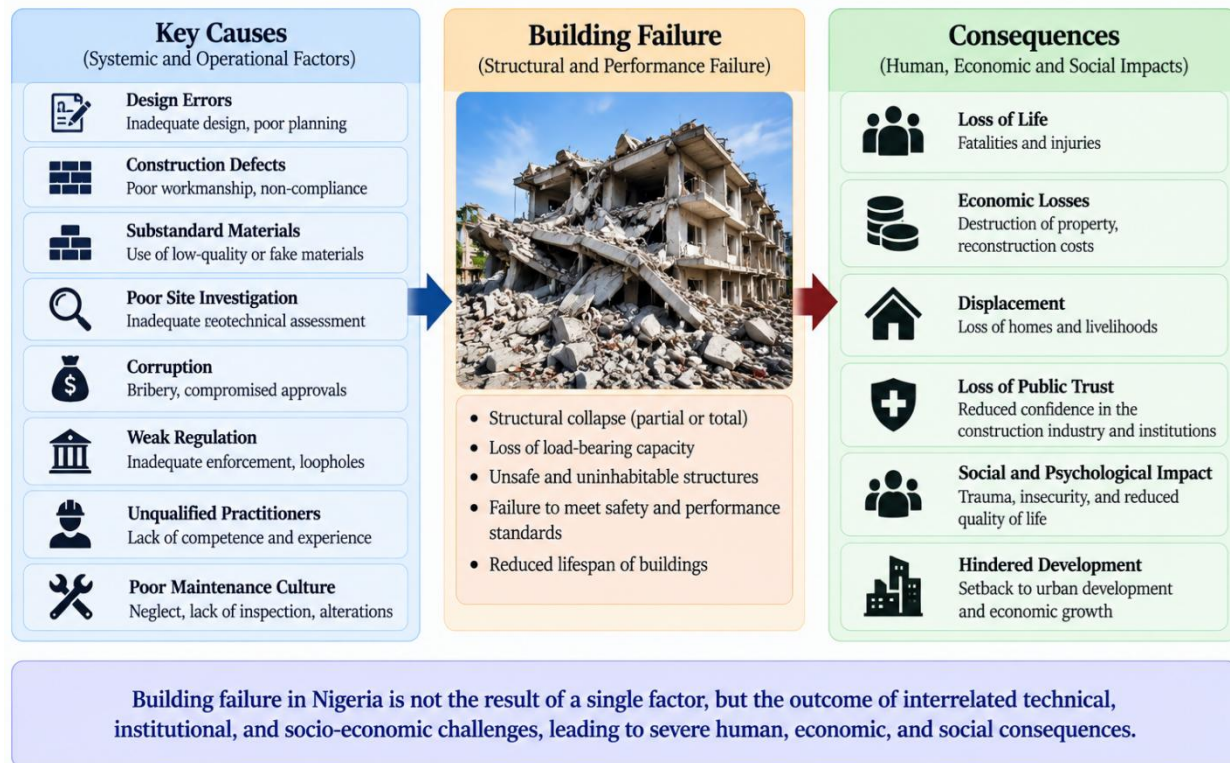
2.5 Professional and Technical Deficiencies

The quality of professional practice in the Nigerian construction industry varies widely. At one end of the spectrum are highly qualified architects, engineers, and builders who adhere to international standards and produce work of excellent quality. At the other end are unqualified practitioners—often referred to as "quacks"—who lack formal training and certification but nevertheless operate in the industry.

The engagement of unqualified professionals is a persistent problem. Clients seeking to minimize costs may hire practitioners who charge lower fees but lack the competence to design or construct buildings safely. In some cases, clients may be unaware of the qualifications (or lack thereof) of those they engage. In other cases, clients may knowingly choose unqualified practitioners to avoid the higher costs and more rigorous oversight that qualified professionals require.

Even among qualified professionals, deficiencies in practice may contribute to failures. Inadequate site investigation may lead to foundation designs that are inappropriate for soil conditions. Insufficient attention to detail in design may leave critical connections underspecified. Poor communication between designers and builders may result in misinterpretation of drawings or specifications. And inadequate supervision during construction may allow defects to go uncorrected.

Figure 1. Causes and Consequences of Building Failure in Nigeria
From Systemic Factors to Societal Impacts



3. Frugal Innovation: Principles and Practices

3.1 Defining Frugal Innovation

Frugal innovation refers to the development of products, services, and business models that provide value to customers under conditions of resource constraint. The term encompasses a range of practices—also described as "jugaad," "reverse innovation," or "constraint-based innovation"—that share a common emphasis on doing more with less.

Velananda et al. (2022) define frugal innovation as a resource-constrained strategy created to generate affordable, acceptable goods for consumers who cannot purchase equivalent conventional products. Key characteristics include low cost, simplicity, sustainability, and focus on core functionality. Frugal innovations are not merely cheaper versions of existing products; they represent fundamentally different approaches that achieve acceptable performance through creative use of available resources.

The concept has gained prominence as firms and researchers have recognized that innovation is not confined to well-funded laboratories in developed countries. Some of the most creative solutions to pressing problems—in healthcare, energy, transportation, and housing—have emerged from the constraints of developing economies, where necessity

drives invention and limited resources force creative problem-solving.

3.2 Case Studies in Frugal Innovation

The literature on frugal innovation provides numerous examples of successful products and business models that have addressed unmet needs in developing economies. Several of these have direct relevance to construction and infrastructure.

The Jaipur Foot represents one of the most celebrated examples of frugal innovation. Developed in India to provide affordable prosthetics to amputees, the Jaipur Foot costs approximately \$45—a fraction of the cost of conventional prosthetics in developed countries. Made from locally available materials including rubber, plastic, and wood, it is flexible, durable, and suitable for use without shoes—an important consideration in contexts where many people walk barefoot. The innovation has restored mobility and dignity to over 100,000 amputees worldwide (Velananda et al., 2022).

The Nokia 1100 mobile phone exemplifies frugal innovation in consumer electronics. Introduced in 2003 for developing markets, it stripped away features not essential to basic communication while adding functionality—including a flashlight—that was highly valued by users with limited access to electricity. Its low cost, durability, and dustproof design made it accessible to consumers who could not afford conventional phones, and

it became one of the best-selling phones in history (Velananda et al., 2022).

M-KOPA demonstrates frugal innovation in business models as well as products. The company provides solar energy systems to households in Kenya through a pay-as-you-go model that makes the technology affordable for low-income consumers. Customers pay a small deposit and then make daily micropayments via mobile phone, eventually owning the system outright. The model addresses the upfront cost barrier that prevents many households from accessing solar energy while also providing a revenue stream for the company (Velananda et al., 2022).

3.3 Principles of Frugal Innovation

Analysis of successful frugal innovations reveals several common principles. First, frugal innovations focus on core functionality, stripping away features that add cost without adding value for the target market. The Nokia 1100 did not attempt to compete with smartphones on features; it focused on doing basic communication well at a price point that was accessible to low-income consumers.

Second, frugal innovations leverage local resources and capabilities. The Jaipur Foot uses locally available materials and local manufacturing processes, reducing costs while also creating employment opportunities. This localization also ensures that products are adapted to local conditions—the Jaipur Foot's suitability for barefoot walking being a prime example.

Third, frugal innovations often involve novel business models that address affordability constraints. M-KOPA's pay-as-you-go model is a case in point, enabling customers to spread the cost of solar systems over time in amounts that match their cash flow patterns.

Comparison of Building Failure and Frugal Innovation

Dimension	Building Failure	Frugal Innovation
Primary driver	Resource constraints and weak institutions	Resource constraints and unmet needs
Typical response	Cost-cutting and regulatory avoidance	Creative adaptation
Use of resources	Often substandard materials/practices	Local and available resources
Institutional relationship	Often exploits governance gaps	May compensate for governance gaps
Main outcome	Safety/quality failure	Affordable functional solution
Key risk	Structural failure and loss	Safety/quality if inadequately regulated
Governance need	Strong accountability	Flexible but safety-oriented support

4. Synthesis: The Frugality-Failure Paradox

4.1 Common Roots in Resource Constraint

Fourth, frugal innovations are typically developed through iterative processes of experimentation and refinement. Rather than attempting to design the perfect solution from the outset, innovators start with a rough prototype, test it in real-world conditions, and improve it based on feedback. This approach allows them to learn quickly and adapt to changing circumstances.

3.4 Frugal Innovation in Construction and Housing

While the case studies in the frugal innovation literature focus primarily on consumer products and services, the principles apply equally to construction and housing. The need for affordable housing in developing economies is enormous, and conventional approaches—whether public housing programs or private market solutions—have failed to meet this need at scale.

Frugal approaches to housing might include the use of locally available and sustainable building materials, such as compressed earth blocks, bamboo, or recycled materials. They might involve construction techniques that are simpler and less expensive than conventional methods, such as incremental building that allows families to expand their homes over time as resources permit. They might involve business models that make housing more affordable, such as rent-to-own arrangements or community-based construction cooperatives.

The challenge is to ensure that frugal approaches to construction do not sacrifice safety or quality. The same resource constraints that drive innovation can also create vulnerabilities—the temptation to cut corners on materials, to skip critical steps in construction, or to forego necessary inspections. The goal must be to harness the creative potential of frugal innovation while ensuring that minimum standards for safety and durability are maintained.

Building failure and frugal innovation appear to be opposites: one represents the breakdown of construction systems, the other represents their creative adaptation. Yet

both arise from the same underlying conditions—resource scarcity, weak institutions, and the adaptive responses of actors seeking to meet needs within constrained environments.

Resource scarcity creates pressure to reduce costs. In the context of building failure, this pressure manifests as the use of substandard materials, the hiring of unqualified workers, and the evasion of regulatory requirements. In the context of frugal innovation, it manifests as the development of creative solutions that achieve acceptable performance at lower cost.

Weak institutions create both problems and opportunities. On one hand, weak enforcement of building codes and regulations creates opportunities for negligent or corrupt behavior that leads to failure. On the other hand, weak institutions may leave gaps that frugal innovators fill—providing services or products that formal institutions have failed to deliver.

The adaptive responses of actors are key to understanding both phenomena. In the case of building failure, actors respond to incentives—the opportunity to increase profits through cost-cutting, the opportunity to avoid regulatory burdens through bribery—in ways that undermine safety and quality. In the case of frugal innovation, actors respond to unmet needs by developing creative solutions using available resources.

4.2 The Governance Gap

The concept of a governance gap captures the space between what formal institutions are supposed to do and what they actually accomplish. In the construction sector, the governance gap manifests in several ways.

First, there is a gap between regulations and enforcement. Building codes specify requirements for safe construction, but these requirements are not consistently enforced. The result is a situation in which formally compliant buildings may not exist in practice, and where the safety of structures depends on the conscientiousness of individual actors rather than on systematic regulatory oversight.

Second, there is a gap between professional standards and actual practice. Professional bodies establish standards for competence and ethics, but not all practitioners adhere to these standards. Unqualified individuals operate in the industry, and even qualified professionals may deviate from best practices when under pressure to reduce costs or accelerate schedules.

Third, there is a gap between the needs of the population and the capacity of formal systems to meet those needs. Rapid urbanization creates demand for housing and infrastructure that formal construction systems cannot satisfy. The result is the growth of informal settlements where construction may not comply with any standards, and where residents are exposed to risks that formal systems would not tolerate.

4.3 Innovation as Adaptation

Frugal innovation can be understood as an adaptive response to the governance gap. Where formal systems fail to provide needed goods and services, entrepreneurs and communities develop their own solutions. These solutions may be more appropriate to local conditions than formal alternatives, and they may be more accessible to populations that formal systems have failed to reach.

The relationship between frugal innovation and governance is complex. On one hand, frugal innovation may compensate for governance failures, providing goods and services that formal systems do not deliver. On the other hand, frugal innovation may undermine governance by operating outside formal frameworks, avoiding the taxes and regulations that would otherwise apply.

The challenge for policy is to find ways to harness the creative energy of frugal innovation while ensuring that minimum standards for safety and quality are maintained. This requires governance frameworks that are flexible enough to accommodate diverse approaches and contexts but robust enough to prevent the corner-cutting that leads to building failure.

4.4 Toward Integrated Solutions

Addressing the frugality-failure paradox requires integrated approaches that address both the causes of failure and the conditions that enable innovation. Several elements of such an approach can be identified.

Strengthening regulatory enforcement is essential to prevent building failure. This requires adequate resources for regulatory agencies, transparency in their operations, independence from political interference, and severe penalties for violations. It also requires coordination among agencies with overlapping responsibilities to ensure comprehensive coverage and prevent gaps.

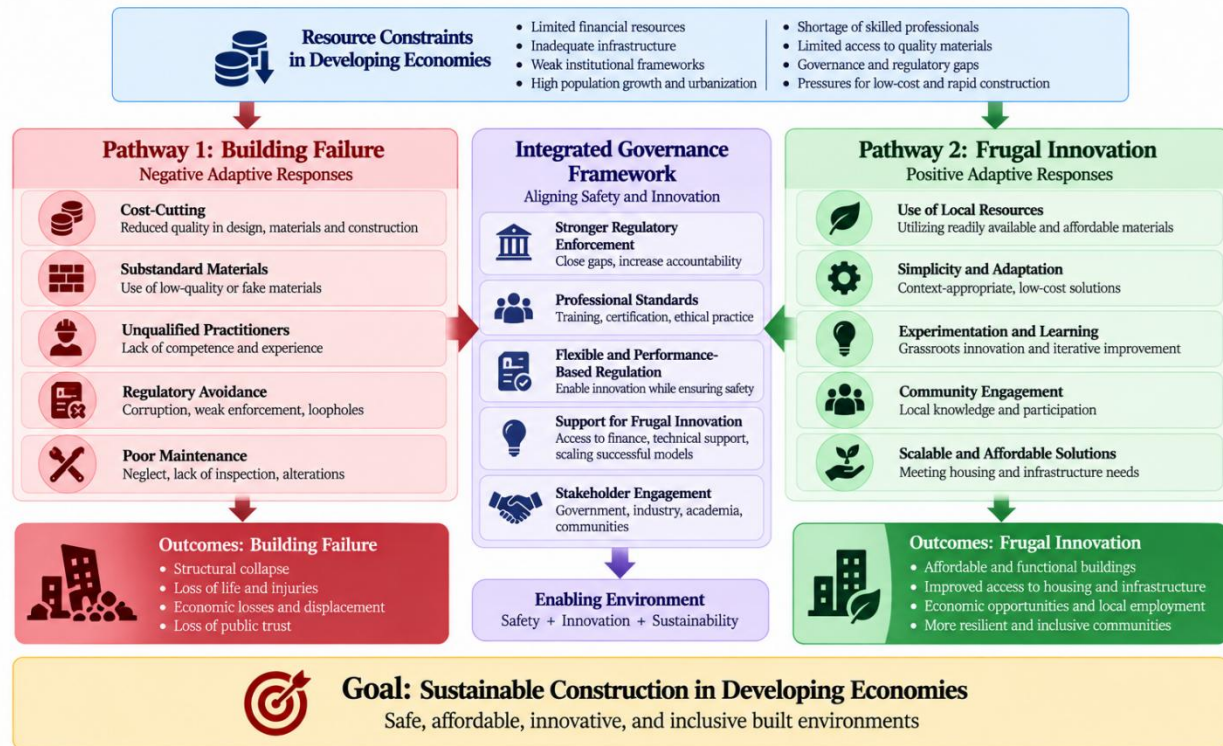
Supporting professional development is essential to raise the overall quality of practice in the construction industry. This includes training programs for existing practitioners, certification requirements for entry into the profession, and continuing education to keep skills current. It also includes efforts to raise awareness among clients about the importance of engaging qualified professionals.

Creating space for frugal innovation requires flexibility in regulatory frameworks. Not all construction needs to meet the same standards—a temporary structure may not need the same level of engineering as a permanent building—but all construction must meet minimum safety requirements. Regulations should be proportionate to risk, with more stringent requirements for higher-risk structures and contexts.

Engaging communities in construction governance can help bridge the gap between formal systems and actual practice. Community-based monitoring, participatory planning processes, and local oversight mechanisms can supplement formal regulation and create additional

accountability. They can also help identify frugal solutions that are appropriate to local conditions.

Figure 2. The Frugality–Failure Paradox in Construction
From Resource Constraints to Sustainable Solutions



5. Implications for Policy and Practice

5.1 Regulatory Reform

The first priority for addressing building failure in Nigeria and similar contexts is regulatory reform. This involves not only strengthening enforcement but also rethinking the regulatory framework to make it more effective and more appropriate to local conditions.

Regulatory reform should begin with a clear articulation of objectives. The primary objective is to ensure the safety of buildings—to prevent collapses that cause death and injury. Secondary objectives include ensuring that buildings meet functional requirements, that they are accessible to those who need them, and that they contribute to sustainable development.

Achieving these objectives requires a regulatory framework that is both comprehensive and enforceable. Comprehensive means covering all aspects of construction—design, materials, construction methods, inspections, maintenance—and all types of buildings, from single-family homes to large commercial structures. Enforceable means having the resources, authority, and political will to ensure compliance.

Several specific reforms can be identified. First, strengthening inspection and enforcement capacity is essential. This requires increasing the number of qualified inspectors, providing them with adequate equipment and training, and protecting them from political interference and corruption. Second, increasing transparency in the permitting and approval process can reduce opportunities for corruption and increase public confidence. Third, establishing clear accountability mechanisms—including penalties for violations and remedies for victims of failure—can create incentives for compliance.

5.2 Professional Standards

Raising the quality of professional practice in the construction industry requires both regulatory measures and voluntary efforts by professional bodies and individual practitioners.

Regulatory measures include requiring licensing or certification for all practitioners who design or supervise construction, establishing minimum standards for education and training, and enforcing codes of ethics that prohibit negligence and corruption. These measures should apply not only to architects and engineers but also to contractors, builders, and inspectors.

Voluntary measures include continuing professional development programs that keep practitioners current with best practices and new technologies, mentorship programs that help new practitioners develop competence, and

professional codes of conduct that establish expectations for integrity and quality. Professional bodies can play an important role in promoting these measures and in disciplining members who violate them.

5.3 Supporting Frugal Innovation

Harnessing the potential of frugal innovation requires creating an enabling environment that supports experimentation and learning while ensuring that minimum safety standards are maintained.

Several approaches can be considered. First, regulatory frameworks can be designed with flexibility to accommodate diverse approaches and contexts. Rather than imposing uniform requirements on all construction, regulations can establish performance standards that allow for multiple means of compliance. This approach encourages innovation while ensuring that safety objectives are met.

Second, support for research and development can help frugal innovators refine their solutions and demonstrate their effectiveness. This might include funding for pilot projects, technical assistance for innovators, and platforms for sharing knowledge and experience.

Third, recognition and celebration of successful frugal innovations can inspire others and build support for the approach. Awards programs, media coverage, and integration of frugal innovation into education and training can all help raise the profile of this approach.

5.4 Building Institutional Capacity

Underlying all of these measures is the need to build institutional capacity—the ability of organizations to perform their functions effectively and accountably. In the construction sector, this means strengthening regulatory agencies, professional bodies, educational institutions, and research organizations.

Building institutional capacity is a long-term endeavor that requires sustained investment and political commitment. It involves developing human resources—recruiting, training, and retaining qualified staff. It involves developing organizational systems—procedures for planning, budgeting, monitoring, and evaluation. And it involves developing cultures of integrity and accountability—norms and values that guide behavior and create expectations for performance.

5.5 International Cooperation

The challenges of building failure and sustainable construction are not unique to Nigeria or even to developing economies. Countries around the world face similar issues, and there are opportunities for learning from each other's experiences.

International cooperation can take several forms. Sharing best practices in regulation, professional development, and enforcement can help countries

improve their own systems. Collaborative research on construction materials, methods, and technologies can accelerate progress. And mutual recognition of professional qualifications can facilitate the movement of skilled practitioners across borders.

6. Conclusions

The paradox of frugality and failure in construction reflects the broader challenges facing developing economies as they seek to meet pressing needs for housing and infrastructure. Resource constraints create pressure to reduce costs, which can lead to the corner-cutting that causes building failure. The same constraints also drive creative responses—frugal innovations that find ways to meet needs with less.

Resolving this paradox requires governance frameworks that simultaneously strengthen accountability and enable innovation. Regulatory enforcement must be improved to prevent the corruption, negligence, and incompetence that lead to building failure. Professional standards must be raised to ensure that practitioners have the competence and integrity to perform their work safely. And space must be created for frugal innovation—for the creative solutions that have demonstrated the capacity to provide goods and services in contexts where conventional approaches have failed.

The path forward is not easy. Building institutional capacity takes time, resources, and sustained political commitment. Changing cultures of corruption and negligence requires addressing deep-seated norms and incentives. And balancing the imperatives of safety and affordability requires difficult trade-offs.

Yet the stakes are high. Every building collapse represents not only a failure of engineering or regulation but also a failure of governance—a failure to protect the lives and livelihoods of those who depend on the built environment. And every successful frugal innovation represents not only a business opportunity but also a contribution to human welfare—a demonstration that creativity and resourcefulness can overcome even the most daunting constraints.

The challenge for policymakers, practitioners, and researchers is to understand these dynamics and to develop responses that address both the failures and the possibilities. This requires moving beyond simplistic narratives—whether of corruption and incompetence or of innovation and entrepreneurship—to recognize the complexity of the situations in which construction unfolds. It requires engaging with the realities of resource constraints, weak institutions, and adaptive behavior that characterize construction in developing economies.

Ultimately, the goal is not to eliminate frugality but to channel it in productive directions. The creativity and resourcefulness that characterize frugal innovation are assets that should be nurtured and supported. The challenge is to create conditions in which these assets can

be deployed without sacrificing the safety and quality that all buildings should provide.

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