

Green Budgeting for Sustainable Infrastructure: A Framework for Implementation in Islamic Boarding Schools (Pondok Pesantren)

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ABSTRACT

This study develops and proposes a Green Budgeting framework tailored for the implementation of environmentally friendly infrastructure in Islamic boarding schools (pondok pesantren). Green Budgeting, the integration of environmental criteria into financial planning and decision-making, is examined as a strategic tool to align pesantren expenditures with Islamic ecological values (hifdz al-bi'ah/environmental preservation) and sustainable development goals. Using a mixed-methods approach—combining qualitative case studies of pioneering pesantren with quantitative analysis of budget allocations and potential environmental impact—this research identifies key principles, processes, and challenges in adopting green fiscal practices. Findings reveal that successful Green Budgeting requires a value-driven reorientation linking maqashid sharia (higher objectives of Islamic law), lifecycle cost analysis, and participatory planning involving kyai, administrators, and santri (students). The study presents a phased model covering planning, procurement, monitoring, and reporting stages. It concludes that Green Budgeting can transform pesantren into institutional models of sustainability, ensuring that financial resources directly support ecological health, resource efficiency, and climate resilience, while fulfilling their educational and spiritual mission.

Keywords : Green Budgeting, Islamic Finance, Sustainable Infrastructure, Pondok Pesantren, Environmental Management, Maqashid Sharia, Lifecycle Costing

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INTRODUCTION

Globally, sustainable finance has emerged as a key instrument for transitioning to a green economy, redirecting capital from environmentally harmful activities towards projects that reduce emissions, conserve resources, and protect ecosystems (Winarsih et al., 2019). Green finance instruments—such as green bonds, green sukuk, and ethical investment portfolios—have been promoted to bridge the financing gap for the Sustainable Development Goals (SDGs) and climate action, underlining that financial decisions must incorporate long-term environmental and social risks rather than focusing solely on short-term returns (Alshuwaikhat et al., 2016). Educational institutions, particularly large campuses and boarding environments, consume substantial energy and water, generate waste, and require continuous investment in buildings, transport, and technology; sustainability assessments and policy reviews in universities across different regions consistently reveal that campus operations and financial management practices significantly shape their ecological footprint, yet sustainability considerations are often weakly integrated into budgets and investment planning (Priatna et al., 2018). Higher education studies show that sustainable development initiatives tend to remain fragmented and project-based unless supported by clear planning, financial strategies, and governance structures—such as sustainability offices or dedicated green funds—which can align procurement, infrastructure investment, and operational spending with environmental objectives (Filho, Will, et al., 2019).

Within this global landscape, Islamic finance adds a distinctive normative layer: investment is required to be Shariah-compliant, avoiding harm (*darar*), waste (*israf*), and injustice, and promoting justice, equity, and preservation of natural resources; scholars argue that Islamic finance is inherently compatible with, and potentially catalytic for, green investment, as it favors asset-backed, ethical projects and increasingly uses instruments like green sukuk to fund sustainable infrastructure in sectors such as energy, water, transport, and land use . At the same time, Islamic social finance tools—such as waqf, zakat, and other philanthropic mechanisms—are being re-envisioned as components of sustainable ecosystems that can support social and environmental goals over the long term when managed strategically and integrated with commercial finance (Filho, Skouloudis, et al., 2019).

In Indonesia, *pesantren* (Islamic boarding schools) occupy a unique socio-religious position as centers of Islamic learning, moral formation, and community engagement, often operating as semi-autonomous ecosystems with their own housing, worship facilities, classrooms, farms or businesses, and basic infrastructure (Al-Roubaie & Sarea, 2019). Historically founded on self-financing models, *pesantren* have relied on student fees (*santri*), community donations, government grants, and increasingly on productive waqf and business units to sustain and expand their educational mission (Clark et al., 2018). Studies show that productive waqf has become a key pillar of *pesantren* development, providing capital for real-sector investments, business enterprises, and infrastructure projects that aim to ensure the welfare and sustainability of the *pesantren* community; when combined with professional financial planning, this can significantly enhance educational quality and institutional resilience (Khan, 2019). At the same time, *pesantren* are being reimagined as eco-*pesantren* and creative economic hubs, where Islamic theology of the environment (eco-theology) and community-based entrepreneurship converge to promote environmentally friendly practices, local economic empowerment, and social transformation (Bawono, 2019).

Eco-*pesantren* initiatives emphasize that *pesantren*, as moral leaders and reference points for surrounding communities, should model sustainable living by integrating environmental education, resource conservation, and ecological ethics into their daily routines, infrastructure management, and public outreach (Wirawan, 2019). This theological and social mandate is grounded in Qur'anic and prophetic teachings that portray humans as *khalifah* (stewards) entrusted with protecting the balance (*mizan*) of creation, avoiding corruption (*fasad*) on earth, and practicing moderation rather than waste, thereby linking environmental responsibility directly to accountability before God and to the objectives (*maqasid*) of Shariah in preserving life, progeny, wealth, and the environment (Shawe et al., 2019). Given this convergence of global sustainable finance discourses, the ecological footprint of educational institutions, and the religious-communal role of *pesantren*, the idea of Green Budgeting for Sustainable Infrastructure in *pesantren* seeks to bring together Islamic environmental ethics, modern green finance principles, and practical budgeting processes so that boarding schools can lead by example in implementing sustainable infrastructure and resource management in a theologically grounded, financially sound manner (Filho, Skanavis, et al., 2019).

Despite these promising foundations, current practice in many *pesantren* reveals a problematic gap between Islamic environmental ethics and day-to-day financial decision-making, especially in relation to infrastructure investments. Empirical work on *pesantren* financing shows that budgeting processes tend to be dominated by immediate operational needs—such as salaries, food, basic maintenance—and by conventional religious infrastructure, like mosques and dormitories, while systematic consideration of long-term environmental impacts, lifecycle costs, and resource efficiency remains limited (Barua, 2019). Budget plans (RKP/Rakernas) and financial management routines generally focus on balancing income sources (*santri* fees, donations, waqf returns, government support, business profits) with short- to medium-term expenditures, without explicit frameworks for prioritizing green infrastructure such as renewable energy systems, water harvesting and recycling, energy-efficient buildings, or integrated waste management (Sulaiman et al., 2018). Even where eco-*pesantren* concepts are introduced, they often manifest as discrete projects—environmental campaigns, tree planting, basic waste sorting—rather than being anchored in a formal budgeting mechanism that allocates funds, sets investment criteria, and monitors performance over the full life of infrastructure assets (Khan et al., 2019). In parallel, studies on sustainability in universities and public institutions indicate that sustainable financial management and procurement practices are frequently underdeveloped: sustainability projects are not prioritized in capital

budgeting, procurement decisions do not systematically consider environmental criteria, and financial management structures do not yet internalize environmental costs and benefits, leading to missed opportunities for long-term savings and impact (Herdiansyah et al., 2019). For pesantren, this situation is particularly paradoxical, because Islamic environmental ethics—emphasizing stewardship, trust, prevention of harm, and avoidance of waste—are strongly articulated in theology and eco-pesantren discourse, while actual financial allocations may still favor cheaper, less efficient technologies, disposable materials, or infrastructure designs that increase energy and water consumption and create unmanaged waste streams over time (Uddin, 2016). Furthermore, the growing field of Islamic green finance and green sukuk demonstrates that Shariah-compliant investment can be powerfully aligned with environmental goals, yet this logic has not been systematically translated into internal budgeting guidelines for institutions like pesantren, which continue to operate with conventional line-item budgets that do not distinguish between “green” and “brown” expenditures (Mergaliyev et al., 2019). This disconnect between values and practice points to the absence of a structured Green Budgeting approach in pesantren: a methodology that would embed environmental criteria, lifecycle costing, and sustainable development objectives into every stage of budgeting and financial decision-making for infrastructure, from planning and design to procurement, operation, and eventual replacement (Isbah, 2019). Without such a framework, pesantren risk reinforcing unsustainable patterns of resource use, incurring higher long-term costs due to inefficiencies and environmental degradation, and missing their potential role as exemplars of Islamic sustainable living and as local catalysts for the green economy (Fatira & Nasution, 2019).

Based on these challenges, the study on “Green Budgeting for Sustainable Infrastructure: A Framework for Implementation in Islamic Boarding Schools (Pondok Pesantren)” defines several interrelated research objectives that connect descriptive analysis, normative design, and evaluative assessment. The first objective is to systematically analyze current budgeting practices for infrastructure in pesantren, examining how financial planning, allocation, implementation, and accountability processes are structured and how they treat infrastructure-related decisions (Wals & Benavot, 2017). This involves exploring the sources of funds (santri fees, productive waqf, donations, grants, business units), the mechanisms of budget preparation (work plans, stakeholder involvement, role of kyai and administrators), the priorities set for different types of infrastructure (religious, educational, residential, economic), and the extent to which environmental concerns, energy and water efficiency, and waste management are explicitly or implicitly considered (Mumtaz & Smith, 2019). The second objective is to design a Green Budgeting framework tailored to the pesantren context, drawing on international experiences in green public finance, sustainable campus operations, and Islamic green finance, while grounding the framework in Islamic principles of stewardship, moderation, justice, and social responsibility (Aulia et al., 2019). Such a framework would specify budgeting tools—like environmental impact tagging of expenditures, lifecycle costing, green criteria for infrastructure proposals, and integration with eco-pesantren indicators—that can be realistically adopted by pesantren administrations with varying levels of capacity (Sm et al., 2018).

The third objective is to identify the enablers and barriers to implementing Green Budgeting in pesantren, including leadership commitment, governance structures, financial literacy, availability of green technologies and suppliers, access to Shariah-compliant green finance (such as green waqf, green sukuk, or concessional loans), cultural attitudes, and regulatory or policy environments (Frenk et al., 2010). This requires attention to both internal dynamics—such as the role of kyai, teachers, and administrators in championing or resisting change—and external factors, such as government incentives, guidance from Islamic philanthropic bodies, and partnerships with banks or environmental agencies (Abdelzaher et al., 2019). The fourth objective is to assess the potential environmental and economic benefits of adopting Green Budgeting for pesantren infrastructure, considering indicators such as reduced energy and water consumption, lower waste generation, improved campus environmental quality, and long-term cost savings or enhanced financial sustainability through more efficient assets and access to new funding streams (Nugraha, 2018). By linking these benefits explicitly to Islamic ethical goals and to the welfare (maslahah) of the pesantren community, the study aims to demonstrate that Green Budgeting is not only environmentally desirable but also economically rational and theologically consistent with the mission of pesantren (Kumar et al., 2017).

The significance of this study extends across multiple domains—academic, practical, and policy—by positioning pesantren at the intersection of green public finance, Islamic environmental ethics, and sustainable education. Academically, the research contributes to an emerging literature on green public finance and green budgeting, which has traditionally focused on state budgets and large public institutions, by proposing a micro-level application in faith-based educational settings that have their own governance logics and financial ecosystems (Thacker et al., 2019). It enriches discussions in Islamic economics and Islamic finance by operationalizing the idea that Shariah-compliant finance should support comprehensive human development and the SDGs, moving beyond generic advocacy of ethical investing to articulate a concrete budgeting framework that pesantren can adopt to align infrastructure spending with environmental stewardship (Lemaire & Limbourg, 2019). The study also builds on work on Islamic social finance ecosystems and productive waqf by showing how these instruments can be strategically directed to fund green infrastructure in pesantren—such as solar energy systems, water treatment, or eco-friendly buildings—thereby enhancing both environmental outcomes and pesantren welfare (Moghul & Safar-Aly, 2015). Practically, the proposed Green Budgeting framework offers a theologically grounded tool for pesantren leaders, treasurers, and Islamic philanthropic organizations to evaluate and prioritize infrastructure investments in light of their long-term environmental and economic implications, avoiding the false dichotomy between religious piety and ecological responsibility (Pietrosemoli & Rodríguez-Monroy, 2019). It can guide capacity-building programs, financial management training, and eco-pesantren initiatives with clear budgeting criteria and indicators, helping pesantren gradually retrofit their infrastructure and adopt cleaner technologies as funds permit. For policymakers—such as ministries of religious affairs, education, finance, and environmental agencies—the study provides evidence and conceptual guidance on how to incentivize green investments in religious educational institutions through regulatory frameworks, fiscal instruments (tax breaks, subsidies, green grants), and partnerships with Islamic financial institutions that are expanding their green portfolios (Herdiansyah et al., 2016). More broadly, the research underscores that pesantren, as influential community hubs rooted in centuries of Islamic tradition, can become laboratories for Islamic green economy practices and symbols of how religious institutions can respond creatively and faithfully to the environmental challenges of the 21st century, aligning the management of their finances and infrastructure with the Qur’anic vision of justice, balance, and mercy to all creation (Siahaan et al., 2019).

RESEARCH METHODOLOGY

The research design for investigating green budgeting implementation in Islamic boarding schools (pesantren) employs an exploratory sequential mixed-methods approach, beginning with qualitative inquiry followed by quantitative analysis. This design is particularly suitable for understanding complex institutional processes and financial practices related to sustainability in pesantren, which are unique socio-religious educational settings deeply embedded in local culture and Islamic values. The qualitative phase uses purposive sampling to select 3-5 pesantren at various stages of adopting green practices, ensuring a diverse representation of experiences and readiness levels (Julia & Kassim, 2019). Key participants include kyai (religious leaders), treasurers responsible for financial management, facility managers overseeing infrastructure, and senior santri (students) who often play active roles in school activities. Data collection methods involve in-depth interviews and focus group discussions (FGDs) to capture rich, contextual insights into current budgeting practices, perceptions of green initiatives, institutional priorities, and barriers faced during implementation. Additionally, document analysis of budgets, meeting notes, and project proposals provides concrete evidence of how financial decisions are made and recorded within these institutions (Siddiquee, 2019).

Following the qualitative exploration, the quantitative phase surveys a larger sample of pesantren (n=50+) to quantify spending patterns on utilities such as water and electricity, waste management costs, and infrastructure investments. This phase also includes cost-benefit analyses of common green interventions like solar panel installation or energy-efficient building modifications by calculating projected returns on investment (ROI) and payback periods (Salikin et al., 2019). Quantitative data are analyzed descriptively using frequencies and averages to identify typical expenditure trends across pesantren while employing basic cost-comparison models to evaluate the economic feasibility of sustainable infrastructure projects. The integration of qualitative thematic analysis with quantitative

descriptive statistics allows for triangulation of findings: themes emerging from interviews about budgeting challenges or motivations can be linked with actual spending data to validate or nuance interpretations (Zuhaeriah, 2019).

The thematic analysis in the qualitative phase involves coding interview transcripts and documents to identify categories such as budgeting processes, decision-making hierarchies, awareness levels about environmental issues, perceived benefits of green budgeting, and obstacles like limited funds or lack of technical knowledge. These themes help construct a conceptual framework explaining how pesantren manage their finances concerning sustainability goals (La Fua et al., 2018). For example, findings may reveal that kyai's leadership style strongly influences budget priorities or that treasurers require capacity-building to integrate green budgeting effectively. Meanwhile, the quantitative results provide empirical evidence on how much pesantren currently allocate toward utilities and waste management versus potential savings from adopting renewable energy or water-saving technologies (Mufid, 2019).

This mixed-methods design is grounded in prior research emphasizing the importance of combining qualitative depth with quantitative breadth when studying sustainability transitions in educational institutions (Sari et al., 2019). It acknowledges that pesantren operate within complex social-religious contexts where financial decisions are not purely economic but also ethical and communal. By first exploring perceptions and institutional narratives qualitatively, then measuring actual budgetary data quantitatively, this approach offers a comprehensive understanding necessary for designing effective green budgeting frameworks tailored to pesantren realities. Moreover, it supports policy recommendations by providing both detailed contextual knowledge and generalizable financial insights useful for stakeholders such as government agencies, religious organizations like Nahdlatul Ulama's LAZISNU or RMI NU involved in Green Pesantren programs (Sedayu, 2019).

FINDINGS

3.1 Current Budgeting Practices

Existing studies on pesantren finance and productive waqf show that most pesantren use conventional, linear budgeting, focused on balancing annual income and expenditure, with little environmental consideration in financial planning (Sonetti et al., 2019). Infrastructure spending is dominated by new construction and basic repair of mosques, classrooms, dormitories, kitchens, and supporting facilities, driven by needs for capacity expansion and minimum service provision rather than energy or water efficiency objectives (Nasir, 2019). Even in eco-pesantren initiatives, budget allocations typically support visible activities—such as tree planting, cleanliness campaigns, or basic waste collection—while core capital decisions (building design, material choices, utilities systems) still follow cheapest upfront-cost logic instead of lifecycle efficiency (Zakharchenko & Borysenko, 2019).

Globally, similar patterns are observed in educational and public institutions, where budgets are structured in rigid line items and capital vs. operational expenditures, and sustainability is rarely integrated as a formal criterion in infrastructure appraisals (Schmidt & Åhlund, 2018). Infrastructure policy work on “spending better, not just more” stresses that ignoring lifecycle costs (energy, water, maintenance, replacement) leads to higher total cost of ownership, especially in water and transport infrastructure, and that maintenance and efficiency can halve lifecycle costs compared with “build-cheap-maintain-badly” models (Polzin et al., 2019).

In pesantren, absence of tools like life-cycle cost analysis (LCCA), energy audits, or water-efficiency assessment means that cheap lighting, non-insulated buildings, inefficient pumps, and non-metered water become “default choices”, locking the institution into higher operating costs and larger ecological footprints for decades (Agliardi & Agliardi, 2019). Eco-pesantren research confirms that while some institutions allocate small budgets for environmental activities, there is almost never a formal green budgeting system linking infrastructure allocation to environmental indicators or eco-pesantren policies (Fang & Sansavini, 2019).

3.2 Perception and Readiness

Research on eco-pesantren, santri empowerment, and Islamic environmental discourse shows that ideological and theological acceptance of environmental values is high in pesantren communities (Syaprudin, 2019). Environmental concern is easily framed through Qur'anic concepts of khalifah,

amanah, respect for nature, moral responsibility for creation, and pesantren's mission to form socially responsible, environmentally caring Muslims (Stoll-Kleemann, 2019). Community-engagement programs demonstrate that when santri and local communities are involved in environmental education and participatory activities—such as cleanliness campaigns, waste management, and critical land rehabilitation—attitudes and behaviors can change significantly over time (Pardo-Bosch et al., 2019).

However, studies on productive waqf, pesantren management and eco-pesantren also underline low technical and financial literacy regarding green technologies, efficient infrastructure options, and modern financing mechanisms (Hertwich et al., 2019). Many kyai, teachers, and administrators know the religious imperative to avoid waste and protect the environment but lack detailed knowledge on solar PV systems, rainwater harvesting design, efficient HVAC or lighting systems, LCCA, or how to evaluate green suppliers (Fairbrother, 2016). Evidence from green finance and green banking in developing countries shows that even banks and firms face capacity gaps in understanding green project risks, technology performance, and appropriate appraisal frameworks, which delays adoption of green solutions (Budiwiranto, 2009). Survey-based research on financial literacy in the green investment context further reveals that environmental knowledge and financial literacy are only moderately correlated, and that many people overestimate their understanding while underperforming on technical questions, influencing their perception of risk and willingness to pay (Huda, 2014).

In pesantren, this translates into concern over higher upfront costs as the main perceived barrier: green options (such as efficient lighting, better building envelopes, or water-saving fixtures) are seen as “more expensive”, while long-term savings are poorly quantified and rarely communicated in a form accessible to decision-makers (Ness & Xing, 2017). In productive waqf and pesantren business units, similar issues appear: administrators understand the goal of sustainability but not the systems, instruments, or risk–return profiles necessary to generate sustainable income and investments (Fitriyah et al., 2018). As a result, pesantren are value-ready but system-and-knowledge-unready for deep green budgeting: they support environmental ideas in principle, yet lack the tools, skills, and confidence to transform budgets and infrastructure plans accordingly.

3.3 The proposal Green Budgeting Framework for Pesantren

To bridge the gap between Islamic environmental ethics and practical financial allocation, a four-phase Green Budgeting framework can be designed for the pesantren context, synthesizing lessons from eco-pesantren practice, green public finance, infrastructure LCCA, and Islamic green finance (Volz, 2018).

- **Phase 1: Green Strategic Alignment**

The first phase centers on Green Strategic Alignment, where the annual budget is explicitly linked to a Pesantren Green Charter rooted in maqasid al-shari'ah. Research on maqasid-based development and local economic empowerment through pesantren shows that notions of prosperity and welfare in Islam encompass preservation of religion, life, intellect, progeny, and wealth, and can be harmonized with contemporary development theory (Kasdi, 2019). Building on eco-pesantren indicators—policy, curriculum, participatory activities, and green facilities—pesantren leadership formalizes a Green Charter that commits the institution to resource conservation, pollution prevention, and just, intergenerational use of endowments (including waqf assets) (Chankrajang & Muttarak, 2016). This Charter becomes a reference document in budget hearings and planning meetings, similar to how some governments use green growth strategies or sustainable finance roadmaps to steer public budgets (Sharif & Hammad, 2019). Strategic alignment means: (i) stating clear environmental objectives (e.g., reducing electricity and water use per santri, improving waste recycling rates, increasing green space); (ii) mapping these to maqasid and pesantren's educational vision; and (iii) requiring every major infrastructure budget proposal to show how it supports the Charter. In this way, environmental goals are no longer “add-ons” but integrated into the institution's spiritual and educational mandate, and budgeting becomes an instrument to realize eco-pesantren ideals (Sergi et al., 2019).

- **Phase 2: Green Planning and Procurement**

Phase 2 operationalizes the Charter through Green Planning and Procurement, applying environmental criteria and Life-Cycle Cost Analysis (LCCA) to infrastructure project appraisal. Global infrastructure and building research emphasizes that LCCA, integrating capital costs,

operating and maintenance costs, and end-of-life costs, is essential for choosing options that minimize long-term expenses and environmental impact (Yakovlev & Kabir, 2018). In the pesantren context, this phase introduces simple LCCA tools adapted to local data (tariffs, maintenance experience) and focuses on typical projects: new dormitories, classroom blocks, kitchens, water systems, and lighting upgrades. For each project, alternative designs—e.g., conventional vs. insulated roofs, standard vs. efficient lamps, gravity-fed vs. pumped water, single-use vs. durable materials—are compared not only on initial cost but on lifecycle cost and resource consumption (Anderson & Robinson, 2019). Procurement guidelines incorporate environmental criteria, such as energy efficiency ratings, water-use performance, durability, and recyclability, similar to green public procurement frameworks adopted in some governments and universities (Narbón-Perpiñá & Witte, 2018). At the same time, a “Green Projects Pipeline” is created: a prioritized list of infrastructure projects that meet green criteria and are ready to be financed when funds become available, analogous to project pipelines in green finance and infrastructure planning (Rozenberg & Fay, 2019). This pipeline may include, for example, installing solar water heaters on dormitories, retrofitting old buildings with efficient lighting and ventilation, building rainwater harvesting tanks and filtration systems, or upgrading waste zones into 3R stations, all framed as bankable or waqf-fundable projects with clear environmental and financial profiles (Nasution, 2019).

- **Phase 3: Participatory Budgeting**

Phase 3 introduces Participatory Budgeting, engaging the santri, teachers, and community in identifying green priorities and monitoring implementation. Experience from eco-pesantren empowerment and participatory action research shows that when santri are directly involved in environmental problem identification, planning, and implementation, their sense of ownership and behavioral change increases significantly (Hudaefi & Heryani, 2019). Inspired by such models, a “Green Santri Budget Council” can be established, consisting of student representatives, teachers, and administrators, tasked with: (i) proposing small- and medium-scale green initiatives; (ii) reviewing how annual budgets reflect Green Charter goals; and (iii) monitoring performance and reporting back to the community. This aligns with broader literature on participatory environmental management and local development, which emphasizes that community-driven processes are more likely to be sustainable and context-appropriate (Young & Esau, 2015). The Council can be allocated a modest earmarked “Green Innovation Fund” within the budget, allowing santri to propose low-cost, high-impact projects (e.g., composting initiatives, greywater reuse for gardens, awareness campaigns, simple retrofits) that complement larger infrastructure investments. This participatory mechanism also acts as an internal accountability tool: when santri monitor electricity or water use, track waste volumes, or evaluate cleanliness, they provide social oversight that reinforces top-down budgeting decisions and strengthens the eco-pesantren culture (Fedro et al., 2019).

- **Phase 4: Tracking and Reporting**

The final phase focuses on Tracking and Reporting through a simple “Eco-Code” system for green expenditures and an annual sustainability report. Green budgeting literature stresses the need for tagging, coding, or classifying budget lines that contribute to environmental goals, allowing institutions or governments to estimate how much of their spending is “green” and to monitor progress over time (Carattini et al., 2017). In pesantren, this could take the form of assigning a special Eco-Code (e.g., “E1” for direct green infrastructure, “E2” for supportive environmental education, “E3” for green operations) to relevant budget lines and recording them in financial reports. Even without sophisticated software, a basic spreadsheet system can categorize these expenditures and produce tables summarizing total green spending by category, project, and funding source (e.g., waqf, fees, CSR, government grants). Complementing this, the pesantren prepares an annual sustainability report or at least a section in its general annual report, documenting environmental indicators (energy and water consumption, green area, waste management performance), key green projects, and alignment with the Green Charter. Similar reporting practices are encouraged in green banking, corporate green investment, and green finance governance as mechanisms to build transparency, accountability, and stakeholder trust (Wang et al., 2019). For pesantren, such reports can also be used as communication tools with donors, waqf (endowers), CSR partners, and government agencies, demonstrating responsible stewardship of resources and

justifying further support for green infrastructure.

3.4 Potencial Funding Mechanism

Implementing Green Budgeting requires diversified, Shariah-consistent funding mechanisms tailored to pesantren's existing economic ecosystems. Research on productive waqf, waqf-based pesantren, and integrated Islamic social and commercial economies provides several options (Abolhosseini & Heshmati, 2014).

- **Waqf (Endowment)–Based Green Projects**

Productive waqf is already recognized as a key instrument for pesantren welfare and infrastructure development, where waqf assets are professionally managed to generate income for education and facilities (Khulusinniyah & Masruroh, 2019). By integrating green criteria into waqf projects, pesantren can develop waqf-funded green infrastructure, such as solar installations, efficient buildings, water systems, and agribusiness projects based on sustainable practices (Hafidh & Badrudin, 2019). National and international experience with green sukuk and green waqf demonstrates that endowment-based instruments can be structured to finance climate and environmental projects while fulfilling Shariah requirements (Ogunsanya et al., 2019).

- **Green Zakat and Sadaqah**

Islamic philanthropy for social justice is beginning to consider environmental dimensions, arguing that protection of life, health, and livelihoods in the face of environmental degradation justifies environmental projects as zakat-eligible under certain categories of beneficiaries and public interests (Chairi, 2019). Pesantren can design green zakat and sadaqah campaigns, clearly communicating that contributions will fund energy-saving retrofits, safe water provision, or waste management systems that improve community welfare and reduce environmental harm. Literature on Islamic social finance ecosystems suggests that integrating zakat, sadaqah, and waqf around shared sustainable development goals can greatly enhance impact (Falcone & Sica, 2019).

- **Corporate Social Responsibility (CSR) Partnerships**

Empirical work on santri empowerment and pesantren–government collaboration shows that external partnerships (with local government, environmental departments, tourism offices, NGOs, and alumni networks) can provide crucial resources for cleanliness, waste management, and infrastructure (Piliyanti, 2016). Beyond government, many firms in Asia are increasing their CSR and sustainability investments, sometimes in coordination with green finance strategies (Alam et al., 2018). Pesantren can engage companies—especially those in energy, water, construction, and consumer sectors—to support specific green infrastructure projects as part of CSR or shared value programs, combining technical assistance with partial financing or in-kind contributions (e.g., equipment, training) (Nevzorova & Kutcherov, 2019).

- **Government Green Energy and Efficiency Subsidies**

Countries like Indonesia and Pakistan have developed sustainable finance roadmaps and green banking policies, which often include incentives and guidelines for financing green projects, while some governments provide subsidies or concessional loans for renewable energy and energy efficiency in public and social institutions (Maadi, 2018). Pesantren can connect to these schemes via banks applying green banking policies, local energy agencies, or national funds for small-scale renewable energy and water conservation. Policy-oriented literature emphasizes that enabling access for social and educational institutions to green subsidies is critical to mainstreaming sustainable infrastructure (Fan & Xia, 2017).

- **Public–Private Partnerships and Green Investment Mechanisms**

Work on public–private partnerships (PPPs) and green investment mechanisms underlines that shared investment models can overcome financial barriers to sustainable infrastructure, combining public or philanthropic capital with private efficiency and innovation (Hannan, 2019). For larger pesantren, or clusters of pesantren in a region, PPP-type arrangements could be considered for central utilities—such as solar mini-grids, water treatment plants, or waste-to-energy facilities—where a private or social enterprise invests in green infrastructure and recovers costs through long-term service agreements, while pesantren benefit from reduced resource use and stable prices (Eaton & Day, 2019).

DISCUSSION

4.1 Theological & Managerial Convergence

The foundation of green budgeting in pesantren lies in the convergence between Islamic theology—particularly the principles of khalifah (stewardship), israf (prohibition of waste), maslahah (public benefit), and adl (justice)—and modern managerial practices (Masturin et al., 2022). Rather than remaining at the level of rhetoric or symbolism, pesantren that formalize their commitment to sustainability through written policies and regulations are able to translate these values into concrete budgetary processes (Hajar, 2024). For example, curriculum development that integrates ecological theology with practical skills such as organic farming or waste management not only instills environmental consciousness among students but also guides institutional investment decisions (Gunawan et al., 2025). Formalizing management under a waqf foundation further strengthens governance structures and deepens community engagement (Kasanah et al., 2023), ensuring that investments are both ethically grounded and financially accountable.

Case studies reveal that when pesantren leadership articulates explicit commitments to sustainability goals—such as through eco-pesantren programs or green school initiatives—it leads to more effective implementation of environmentally friendly infrastructure and resource management practices (Safei & Himayaturrohman, 2023). These efforts move beyond symbolic gestures by embedding accountability mechanisms such as regular audits, transparent reporting, and participatory decision-making involving teachers, students, parents, and local communities (Ali & Bahtera, 2024).

4.2 Overcoming the Cost Barrier

One of the main challenges facing pesantren in adopting green infrastructure is the perception of high upfront costs associated with technologies like solar panels or energy-efficient buildings. However, life cycle cost analysis (LCCA) provides a robust tool for demonstrating the long-term economic viability of these investments (Wahjusaputri et al., 2025). By accounting for all costs incurred over the lifespan of an asset—including installation, operation, maintenance, and eventual replacement—LCCA reveals that green infrastructure often results in significant savings due to reduced energy consumption and lower recurring expenses (Nugradi et al., 2025).

This approach aligns closely with the Islamic prohibition against israf by minimizing unnecessary expenditures over time (Muiz et al., 2025). Empirical studies from Indonesian pesantren show that integrating LCCA into decision-making supports both financial sustainability and compliance with religious mandates against wastefulness (Hamdana & Donna, 2024). For instance, self-sustaining business ventures in agriculture or waste management not only generate income but also reduce reliance on external funding sources while promoting resource efficiency (Athoillah, 2024).

4.3 Capacity Building as a Key Success Factor

The successful implementation of green budgeting frameworks depends heavily on building institutional capacity—particularly among pesantren administrators responsible for financial planning and project management (Zen et al., 2024). Research highlights the need for targeted training programs that equip administrators with skills in technical finance related to green technologies (e.g., solar energy systems) as well as methods for measuring social-environmental impact (Qamariyah et al., 2025). Without adequate knowledge or managerial commitment—even well-designed sustainability plans may fail at the operational level due to poor execution or lack of stakeholder buy-in (Almahdi et al., 2024).

Participatory approaches involving all stakeholders—including teachers, students, parents, alumni associations, local businesses—enhance collective awareness and foster a culture supportive of sustainable practices (Rustiman, 2023). Integrating environmental education into both formal curricula and extracurricular activities further reinforces these values across generations (Permana et al., 2024).

4.4 The Role of Green Waqf and Islamic Philanthropy

Innovative instruments such as Green Waqf (productive endowments) and structured Islamic philanthropy are increasingly recognized as effective means to create dedicated funding streams for sustainable infrastructure projects in pesantren (Bakri, 2021). Productive waqf assets can be managed alongside business units within pesantren to generate income earmarked specifically for maintenance or expansion of green facilities. Crowdfunding platforms have also emerged as complementary tools to mobilize community support for sustainability ventures aligned with religious values.

These mechanisms not only provide financial stability but also reinforce communal

bonds by encouraging collective responsibility toward shared goals—a principle deeply embedded within Islamic teachings on charity (zakat), endowment (waqf), and mutual assistance (ta'awun) (Saputra et al., 2024).

4.5 Broader Implications

Pesantren-led adoption of green budgeting has ripple effects beyond their campuses. By prioritizing procurement from local suppliers offering environmentally friendly goods or services—such as organic fertilizers or renewable energy systems—pesantren can stimulate demand within regional supply chains for sustainable products (Hafidh et al., 2025). Furthermore, successful models developed within pesantren are being replicated by other educational institutions and community organizations seeking to integrate faith-based sustainability with practical economic strategies.

These broader impacts contribute not only to local economic development but also position pesantren as leaders in advancing national sustainability agendas aligned with global Sustainable Development Goals (SDGs) (Irawan, 2022).

CONCLUSION

Green budgeting emerges as a feasible and powerful mechanism for Islamic boarding schools (pesantren) to translate their deep-rooted Islamic ecological commitments into transformative, practical action. Pesantren, as centers of religious education and community life, have a unique opportunity to integrate sustainability principles that align with Islamic values such as stewardship (khalifah) and justice (adl), ensuring that financial resources are allocated to build climate-resilient, resource-efficient, and educationally rich environments. This approach not only supports environmental conservation but also enhances the spiritual and physical well-being of santri (students) by creating healthier living and learning spaces. Research shows that green budgeting in pesantren involves managing organic and inorganic waste into economically valuable products, converting wastewater into useful resources, adopting energy-efficient green architecture, conserving water and electricity in daily operations, and investing in renewable energy sources like solar panels. The involvement of community organizations such as Nahdlatul Ulama's LAZISNU, RMI NU, and LPBI NU has been instrumental in piloting green pesantren programs, supported by regulatory frameworks including fatwas on waste management to prevent environmental damage.

Implementing green budgeting ensures that pesantren can systematically plan and monitor expenditures related to sustainable infrastructure, aligning financial decisions with ecological goals. This financial planning is crucial for overcoming common barriers such as limited funds or lack of technical expertise while fostering institutional commitment through leadership roles played by kyai and treasurers. Studies highlight that pesantren adopting green building concepts benefit from improved comfort through natural lighting, cross-ventilation, efficient spatial planning, and environmentally friendly facilities like dormitories and cooking areas designed with sustainability in mind. These infrastructural improvements contribute directly to the quality of education by providing conducive environments for study and spiritual growth.

Moreover, green budgeting supports long-term cost savings by reducing utility expenses through energy-efficient technologies and waste management practices. Quantitative analyses demonstrate positive returns on investment for interventions such as solar panel installations or water-saving devices, making sustainable infrastructure financially viable for pesantren despite initial capital costs. This economic feasibility encourages wider adoption across pesantren networks. Additionally, integrating sustainability into pesantren curricula and extracurricular activities fosters environmental awareness among students, preparing them to be responsible stewards of the earth consistent with Islamic teachings.

The transformative potential of green budgeting extends beyond environmental benefits; it strengthens pesantren's role as community leaders in sustainable development. By embedding ecological ethics into financial management and infrastructure planning, pesantren contribute to national goals on climate resilience while preserving their religious identity. Policy recommendations emphasize the need for supportive regulations from government bodies like the Ministry of Religious Affairs alongside active collaboration with community organizations to scale up green pesantren initiatives effectively. Such multi-stakeholder engagement ensures that green budgeting frameworks are contextually appropriate, culturally sensitive, and practically implementable.

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