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RESEARCH

Tracking Climate-Conscious Design for the SDGs: A Post-2030 Framework for Sustainable Architecture

Sara Elhussein
Architect and Senior Sustainability Consultant, I Design, London, UK
Email: sara.elhussein.20@ucl.ac.uk
ORCID: 0009-0006-0824-3527

ABSTRACT

PURPOSE: Growing climate pressures and the limitations of prevailing sustainability frameworks have intensified the need to reconsider how architecture responds to environmental and social challenges. Many existing approaches separate climate performance, equity, and systems thinking into discrete categories, leading to fragmented and short-term outcomes. This paper introduces the Six Climate-Conscious Design Actions (SCDA), namely Climate, Site, Design, Decarbonisation, Systems, and Community, as an integrated framework to support early-stage design decision-making beyond the 2030 Agenda.

DESIGN/METHODOLOGY/APPROACH: Drawing on a critical synthesis of peer-reviewed research, professional benchmarks, and practice-based evidence, the framework aligns each design action with environmental and social performance objectives. International references, including the Sustainable Development Goals (SDGs), the RIBA 2030 Climate Challenge, the Whole Building Design Guide, and principles of regenerative and inclusive design, inform the analytical structure.

FINDINGS: Application of the SCDA framework addresses key gaps in contemporary practice by strengthening early interdisciplinary coordination. It enables whole-life carbon reduction, improves passive design performance, and embeds social value considerations, supporting a transition from compliance-led processes toward more transformative sustainability outcomes.

ORIGINALITY/VALUE: Rather than prioritising isolated environmental metrics or context-specific solutions, the SCDA offers a unified and scalable approach. By linking environmental and social dimensions of sustainability, the framework provides design teams with a practical structure for operationalising post-2030 priorities and reframing architectural responsibility in relation to climate action, equity, and wellbeing.

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RESEARCH LIMITATIONS/PRACTICAL IMPLICATIONS: Although conceptual in scope, the framework establishes a clear foundation for practical validation. Further research should examine empirical case studies, performance evaluation, and stakeholder engagement to assess implementation across diverse architectural and cultural contexts.

KEYWORDS: *Climate-Conscious Design; Sustainable Architecture; Early-Stage Design; Decarbonisation; Post-2030 Agenda; Inclusive Design; Systems Thinking in Architecture.*

INTRODUCTION

The accelerating impacts of climate change underscore the urgent need to rethink how the built environment contributes to sustainability. Globally, buildings and construction account for nearly 40% of energy-related carbon emissions and over one-third of final energy use (IEA, 2021). This makes architecture both a major contributor to environmental pressures and a critical sector for advancing resilience and wellbeing. Certification frameworks advanced practice by embedding energy efficiency, carbon reduction, and operational performance into design, yet remain fragmented (Mattinzioli *et al.*, 2020). Research increasingly highlights these limitations. Scholars argue that checklist-based models fragment sustainability into technical items, prioritising mitigation while overlooking adaptation, social equity, and cultural dimensions (Suzer, 2015; Butt, 2025). This imbalance is particularly concerning in the post-2030 context. The Sustainable Development Goals (SDGs) call for integrated attention to environmental, social, and economic dimensions; however, current certification systems allocate disproportionate weight to environmental metrics while marginalising social and economic aspects (Zimmermann *et al.*, 2019; Mensah, 2021).

As the SDGs approach their 2030 milestone, architectural practice faces the task of moving beyond incremental harm reduction towards regenerative and adaptive approaches that embrace circularity, resilience, and inclusivity (Wamsler *et al.*, 2021). This paper responds to these gaps by proposing the Six Climate-Conscious Design Actions (SCDA): Climate, Site, Design, Decarbonisation, Systems, and Community. Developed through critical literature synthesis and benchmarks such as the RIBA 2030 Climate Challenge (RIBA, 2021) and the Whole Building Design Guide (WBDG, 2023), the framework operationalises post-2030 priorities for practice. It aims to help design teams embed sustainability goals at the earliest stages, aligning architecture with planetary boundaries while promoting equity and resilience.

LITERATURE REVIEW

Sustainability became a core concern in architecture due to growing awareness of environmental degradation and resource scarcity. Certification frameworks such as Building Research Establishment Environmental Assessment Method (BREEAM) (1990) and Leadership in Energy and Environmental Design (LEED) (1998) formalised sustainability into measurable categories (Piętocha *et al.*, 2024). While these systems embedded energy and carbon considerations into design, they reduced sustainability to fragmented checklists, with little focus on resilience, equity, or local adaptability (Butt, 2025; Suzer, 2015). Subsequent frameworks such as WELL and the Royal Institute of British Architects (RIBA) 2030 Climate Challenge broadened reporting to include wellbeing, energy, water, and carbon. However, imbalances remain: WELL privileges health, while LEED and BREEAM continue to concentrate on operational energy (USGBC, 2023; BRE, 2022; RIBA, 2021). Despite expansions, systematic gaps persist, particularly in addressing social sustainability. LEED has been critiqued for its narrow interpretation of social values, while systematic reviews show that certified buildings do not consistently deliver improved indoor environmental quality, satisfaction, or health outcomes compared to non-green buildings (Kristoffersen *et al.*, 2024). Tools such as WELL and Facility Innovations Towards Wellness Environment Leadership (FITWEL) place greater emphasis on health (McArthur and Powell, 2020), but broader social and economic dimensions remain under-represented. Current certification systems dedicate 51% of their criteria to environmental issues, 43% to social aspects, and only 5.6% to economic factors (Zimmermann *et al.*, 2019; Mensah, 2021), diverging from the integrated vision of the SDGs.

Performance outcomes also reveal limitations. Although many certified projects outperform conventional buildings, a persistent "performance gap" undermines confidence in these frameworks, with 74% of certified projects delivering above-average performance but 14% performing worse (Li *et al.*, 2022). Lower-level LEED certifications often fail to reflect true efficiency (Amiri *et al.*, 2019), and international systems such as LEED, BREEAM, and Deutsche Gesellschaft für Nachhaltiges Bauen (DGNB) tend to prioritise quantifiable metrics while overlooking resilience, cultural compatibility, and indoor quality (Ascione *et al.*, 2022). Even as national alternatives emerge, LEED remains the most widely adopted globally, reflecting regional policy uptake yet continuing to struggle with adaptability (Rostami, 2025). Alongside performance gaps, methodological shortcomings hinder progress. Scholars increasingly call for approaches that address embodied carbon, whole-life impacts, and climate risks, areas that current systems often neglect in favour of operational energy (Shuttleworth and MacAskill, 2021; Anyanya *et al.*, 2025). Persistent gaps include limited treatment of end-of-life phases, weak incorporation of circular economy principles, and inconsistencies across frameworks (Larsen *et al.*, 2022; Bacheva and Raposo Grau, 2025). Integrating life cycle assessment (LCA), life cycle costing (LCC), and Social Life Cycle Assessment (S-LCA) into Life Cycle Sustainability Assessment (LCSA) is seen as critical for circular transitions (Larsen *et al.*, 2022). At the same time, technological integration remains uneven, with only 29.7% of frameworks automating processes despite LEED's relative progress (Jayasanka *et al.*, 2024). Scholars argue that moving towards dynamic, quantitative methods capable of capturing embodied impacts represents an essential evolution beyond static, checklist-based systems (Sesana and Dell'Oro, 2024).

Equally significant is the imbalance between mitigation and adaptation. While mitigation remains central in BREEAM, LEED, and Green Star, adaptation measures are typically optional rather than mandatory, leaving frameworks heavily mitigation-oriented despite incremental updates (Shuttleworth and MacAskill, 2021). This shortfall heightens the urgency for systems that embed climate risk management into the design and operation of assets. In response to these limitations, new paradigms of regenerative and adaptive design have emerged. The RIBA 2030 Climate Challenge and the Whole Building Design Guide advocate moving beyond minimum standards towards system-based and regenerative approaches. Scholars similarly argue for a shift from "doing less harm" to actively restoring ecological, social systems, with equity placed at the centre of transitions (Leach *et al.*, 2018). Certification models are evolving in this direction, as seen in qualitative, performance-based standards of the Living Building Challenge (Bronstein, 2020). Complementary research highlights resilience planning, biophilic design, and blue/green infrastructure as catalysts for systemic transformation (Mannucci, 2025; Lotfy, 2024; Zhong *et al.*, 2022).

This regenerative turn is reinforced by debates within the Anthropocene discourse, which reframe architecture's responsibility within planetary boundaries. Scholars emphasise the importance of addressing climate risk, resource scarcity, and equity in tandem (Oghenejabor *et al.*, 2025). However, existing certification frameworks remain mitigation-focused and incremental, struggling to adequately account for inclusivity, adaptation, and systemic integration (Wamsler *et al.*, 2021). Post-2030 discourse calls for models that link environmental performance with resilience, wellbeing, and equity. Regenerative design, living building standards, and circular economy practices exemplify this shift, prioritising reuse, disassembly, and whole-life value recovery

(Larsen *et al.*, 2022). However, adoption is constrained by methodological complexity, high costs, and a lack of harmonised metrics.

Within this context, the alignment of architecture with SDGs provides both opportunity and challenge. While the built environment is central to achieving the SDGs, operationalisation remains weak. Analytical models rarely capture all 17 goals (Zimmermann *et al.*, 2019), and fewer than 20% of green building attributes explicitly address SDG targets, raising risks of misalignment and greenwashing (Goubran and Cucuzzella, 2019). Buildings strongly support SDGs 3, 7, 11, and 12, while materials and mitigation strategies contribute indirectly to broader goals; they also generate trade-offs (Wen *et al.*, 2020; Iacobuță *et al.*, 2021). Scholars emphasise the need for frameworks that connect equity, environment, and economy across multiple scales (Latiolais *et al.*, 2021; Wouda Kuipers and Korwatanasakul, 2024). Emerging paradigms such as ecological restoration, regenerative design, and participatory approaches aim to bridge these gaps, yet remain hindered by weak integration and limited validation (Iwuanyanwu *et al.*, 2024; Looman, 2017). Taken together, literature demonstrates that compliance-based certification systems have advanced practice but continue to fragment sustainability into isolated categories. The SCDA directly responds to these systemic gaps. By integrating post-2030 priorities into early-stage design, the framework reframes architecture's role around resilience, equity, and wellbeing, offering a pathway that is both conceptually grounded and operationally actionable.

METHODOLOGY

This study adopts a critical literature review to develop the SCDA framework. The review covered peer-reviewed publications (2015-2025) on sustainability frameworks, lifecycle assessment, building performance, resilience, and social equity, alongside key certification systems such as LEED and BREEAM. The review period was selected to capture both the early foundations of sustainability frameworks, such as LEED and BREEAM, and the most recent advances in regenerative, adaptive, and post-2030 discourse. Professional benchmarks, including the UN Sustainable Development Goals, RIBA 2030 Climate Challenge, and Whole Building Design Guide, were analysed to align the framework with international policy and practice standards. Findings were synthesised thematically and structured into six design actions: Climate, Site, Design, Decarbonisation, Systems, and Community. Although conceptual, the framework establishes a basis for future validation through case studies, project performance analysis, and stakeholder engagement.

Findings: The Six Climate-Conscious Design Actions

As previously discussed in the literature, existing sustainability frameworks often treat environmental, social, and systemic dimensions in isolation. In response, this paper proposes the Six Climate-Conscious Design Actions (SCDA): Climate, Site, Design, Decarbonisation, Systems, and Community. Together, they provide a structured framework integrating mitigation and adaptation, ecological and cultural contexts, lifecycle carbon, systems thinking, and social equity into early-stage design. The SCDA collectively advances the UN's SDGs, including SDG 3 (Good Health and Wellbeing), SDG 5 (Gender Equality), SDG 6 (Clean Water and Sanitation), SDG 7 (Affordable and Clean Energy), SDG 9 (Industry, Innovation and Infrastructure), SDG 10 (Reduced Inequalities), SDG 11 (Sustainable Cities and Communities), SDG 12 (Responsible Consumption and Production), SDG 13 (Climate Action), and SDG 15 (Life on Land). Each action is presented in Tables 1-6, outlining rationale, scope and methodology, design strategies, metrics and deliverables, and anticipated benefits. This structured format demonstrates how the SCDA framework operationalises sustainability priorities beyond Agenda 2030 into actionable guidance for architects, engineers, and policy-makers. Figure 1 presents the infographic of the SCDA framework.

Table 1: Climate

Climate (Mitigation and Adaptation)	
Rationale	Sustainability frameworks prioritise mitigation while leaving adaptation under-specified; this risks designs that perform under baseline conditions but are vulnerable to climate variability. Documented performance gaps between predicted and actual outcomes highlight the need to embed climate robustness from the outset. An integrated approach must address both exterior and interior environments, enabling dynamic responses to climatic variation while maintaining comfort, performance, and occupant health.
Scope and Methodology	• Early design should assess baseline and projected climate scenarios, considering temperature, humidity, precipitation, solar radiation, wind, flooding, and heat-island exposure. • Psychrometric analysis identifies passive opportunities, while future weather files (e.g., CIBSE TM49 2050 and 2080 scenarios) enable resilience testing against overheating. • The methodological process involves: (1) preparing a baseline climate brief; (2) resilience testing under projected scenarios; (3) screening passive strategies; (4) assessing multi-hazard risks, e.g., heatwaves, floods, and storms; and (5) co-ordinating adaptation with embodied and operational carbon goals. • Adaptation pathways with trigger points for phased upgrades should be developed and maintained through a dynamic climate register.

Design Strategies	• Optimise orientation, shading, natural ventilation, and thermal mass. • Enhance outdoor micro-climates using trees, cool pavements, and stormwater management. • Use adaptive interior materials such as phase-change composites, breathable fabrics, and thermally responsive surfaces to stabilise indoor conditions. • Ensure passive survivability during power outages while protecting vulnerable occupants. • Incorporate automated controls to dynamically manage shading, ventilation, and energy demand.
Metrics and Deliverables	• **Metrics:** Evaluation should use indicators such as compliance with TM52 and TM59, referencing CIBSE TM49 climate projections, percentage of comfort hours maintained passively, façade solar loads, and resilience metrics (e.g., time-to-exceed safe indoor temperatures). Additional indicators include Adaptive Comfort Index and mean radiant temperature variation to measure indoor stability. • **Deliverables:** Climate Risk and Response Brief, overheating summary, adaptation register.
Anticipated Benefits	• Improved energy efficiency through reduced reliance on mechanical systems. • Enhanced resilience and comfort by anticipating overheating and extreme weather; strengthened health and wellbeing, particularly for vulnerable occupants. • Lifecycle cost savings from reduced energy and maintenance demand. • Linking indoor environmental quality with exterior climate adaptation reinforces wellbeing, productivity, and social resilience within architecture. • Supports SDGs 3, 7, 11 & 13.

Source: Constructed by author

Table 2: Site

Site (Context, Ecology, and Micro-climate)	
Rationale	Site context is critical to building performance, yet treated as secondary in frameworks that prioritise operational energy and carbon. Neglect of ecological systems, solar access, wind, and hydrology can increase energy demand and reduce comfort. By contrast, ecological, site-responsive design mitigates urban heat islands, manages stormwater, enhances biodiversity, and builds resilience. Blue-green infrastructure and biophilic strategies also advance adaptation, wellbeing, and regeneration.
Scope and Methodology	• Site analysis should extend beyond plot boundaries to capture solar geometry, wind exposure, shading, landscape permeability, and ecological networks. • Integrate geographic information system (GIS) and micro-climate modelling to analyse thermal comfort (Universal Thermal Climate Index (UTCI), Physiological Equivalent Temperature (PET)) and daylight availability. • Early assessment of planning and regulatory parameters (height, setback, zoning) ensures compliance and prevents costly redesigns. • Programmatic analysis should link site qualities with user needs, enabling synergy between passive design, daylight, and ventilation potential.

Design Strategies	• Orient buildings to maximise daylight and ventilation. • Integrate vegetation and permeable surfaces to mitigate heat island and manage stormwater. • Employ green roofs, bioswales, and planted façades to increase biodiversity. • Use courtyards and view corridors to reinforce biophilic quality and human comfort. • Address adjacent conditions such as overshadowing, noise, and pollution, through landscape buffers and façade design.
Metrics and Deliverables	• **Metrics:** Percentage of green and permeable surfaces; stormwater detention capacity; biodiversity indices (species richness, habitat provision); Biodiversity Net Gain (%); habitat-hectares; ecosystem services valuation; daylight access; and micro-climate simulation outputs. • **Deliverables:** Site and Ecology Report, Regulatory Compliance Review, Blue-Green Infrastructure Plan, and Microclimate Analysis Summary.
Anticipated Benefits	• Enhanced thermal comfort and environmental quality. • Reduced dependence on mechanical systems. • Enhanced resilience to flooding and overheating. • Lower maintenance and operational costs. • Stronger integration between architecture, community, and ecology. • Supports SDGs 6, 11, 13 & 15.

Source: Constructed by author

Table 3: Design

Design (Form, Materiality, and Wellbeing)	
Rationale	Early design decisions strongly influence long-term performance, resilience, and user experience. Form, orientation, envelope, and materials determine energy demand, adaptability, and cultural relevance. Certification systems often address these factors indirectly, focusing on operational efficiency while overlooking wellbeing, social equity, and identity. Integrating wellbeing and materiality into early design stages enhances performance and inclusivity.
Scope and Methodology	• Evaluate spatial quality, adaptability, daylighting, ventilation, and embodied carbon from the conceptual stage. • Use parametric modelling, daylight simulation, and airflow analysis to guide performance-led design. • Prioritise materials with verified durability, low toxicity, reduced embodied carbon, and circular potential. • Ensure stakeholder participation to align functional, cultural, and wellbeing goals.
Design Strategies	• Optimise orientation and massing for daylight and ventilation. • Incorporate flexible layouts for future adaptability and resilience. • Specify low-carbon, recyclable, non-toxic materials verified by Environmental Product Declarations (EPDs) and sustainable sourcing standards (Forest Stewardship Council (FSC), BES 6001); enforce low-Volatile Organic Compounds (VOC)/formaldehyde thresholds. • Apply biophilic principles to strengthen mental health, comfort, and connection to nature. • Integrate passive shading, high-performance envelopes, and responsive openings to enhance comfort and reduce energy demand.

Metrics and Deliverables	• **Metrics:** Daylight factor or autonomy, natural ventilation rate, thermal comfort hours, embodied carbon intensity (kg CO_2e/m^2), adaptability indicators, and indoor air quality metrics (CO_2, $PM_{2.5}$, Total Volatile Organic Compounds (TVOCs)). • **Deliverables:** Design Performance Report, Material and Lifecycle Assessment Summary, and Wellbeing and Spatial Quality Review.
Anticipated Benefits	• Enhanced occupant health, satisfaction, and productivity. • Lower operational energy and lifecycle emissions. • Greater adaptability and resilience to evolving needs. • Stronger integration of cultural and social values. • Advancement of regenerative, human-centred architecture. • Supports SDGs 3, 5, 11 & 12.

Source: Constructed by author

Table 4: Decarbonisation

Decarbonisation (Operational and Embodied Carbon)	
Rationale	Decarbonisation is central to sustainable architecture. Current certification frameworks often prioritise operational energy while under-representing embodied carbon across the building life cycle. This imbalance underestimates construction's full climate impact, as operational efficiency improves and embodied emissions grow. Integrating both aspects ensures holistic carbon management and strengthens alignment with long-term climate goals.
Scope and Methodology	• Establish a whole-life carbon budget early, encompassing operational and embodied emissions. • Conduct baseline energy modelling and LCA covering materials, construction, maintenance, and end-of-life stages. • Use scenario testing to evaluate trade-offs among carbon, cost, and performance. • Integrate LCC to support long-term, data-informed decision-making.
Design Strategies	• Reduce energy demand through passive design, efficient systems, and high-performance envelopes. • Incorporate on-site renewables (e.g., photovoltaics, solar thermal) and storage systems. • Prioritise low-embodied-carbon, durable, and circular materials. • Design for adaptability, disassembly, and reuse to extend life spans and enable material recovery. • Employ digital tools (e.g., Building Information Modelling (BIM)-integrated carbon modelling) for iterative optimisation.
Metrics and Deliverables	• **Metrics:** Predicted energy use intensity (kWh/m²), renewable contribution (%), embodied carbon intensity (kg CO_2e/m^2) across life cycle stages, and progress toward net-zero benchmarks. • **Deliverables:** Operational Energy Model, Embodied Carbon Assessment, Whole-Life Carbon Report, and Digital Material Passport for component tracking and reuse.
Anticipated Benefits	• Significant reduction in total greenhouse gas emissions. • Alignment with net-zero and climate-positive targets. • Lifecycle cost optimisation through durable, efficient systems. • Greater resilience to evolving carbon regulations and market mechanisms. • Supports SDGs 7, 9, 12 & 13.

Source: Constructed by author

Table 5: Systems

Systems (Integration and Performance Monitoring)	
Rationale	Buildings operate within interconnected ecological, infrastructural, technological systems; however, current sustainability frameworks often treat systems integration as secondary, focusing on isolated metrics over long-term performance. This fragmentation limits opportunities for efficiency, resilience, and circularity. Embedding systems thinking strengthens synergies between building services, urban infrastructure, energy networks, and natural ecosystems, promoting adaptive and regenerative outcomes.
Scope and Methodology	• Prioritise systems integration from early design, ensuring co-ordination across energy, water, waste, and mobility systems. • Evaluate potential connections to district energy networks, renewable generation, smart grids, and water recycling systems. • Employ digital tools such as BIM and digital twins for predictive analysis, performance simulation, and lifecycle optimisation. • Mandate interoperability standards (e.g., IFC, Brick, Haystack) and establish robust data governance frameworks encompassing privacy, cybersecurity, and ownership. • Integrate performance feedback loops within commissioning and operation to reduce performance gaps and ensure continuous improvement.
Design Strategies	• Enable interoperability with district and community energy systems. • Incorporate greywater recycling, rainwater harvesting, and nutrient recovery systems. • Facilitate low-carbon mobility integration, such as electric vehicle (EV) infrastructure and cycling amenities. • Implement circular material flows through reuse and closed-loop waste management. • Deploy smart sensors and automation to monitor indoor environmental quality, energy, and water use. • Co-ordinate building and landscape systems to enhance resilience against flooding, overheating, resource scarcity.
Metrics and Deliverables	• **Metrics:** System-level energy efficiency, renewable contribution (%), water reuse ratio, waste diversion rate, and reduction in predicted vs actual energy use (%). • **Deliverables:** Systems Integration Plan, Digital Monitoring Framework, Commissioning and Post-Occupancy Evaluation Report, and Measurement and Verification (M&V) Plan (e.g., International Performance Measurement and Verification Protocol (IPMVP)) aligned with Building Services Research and Intelligence Association (BSRIA) Soft Landings to ensure performance accountability.
Anticipated Benefits	• Enhanced resource efficiency and reduced environmental footprint. • Improved operational reliability and building adaptability. • Strengthened resilience through integration with renewable energy and resilient urban infrastructure. • Increased transparency and accountability via real-time performance monitoring. • Reinforced alignment with circular economy principles, extending sustainability beyond the building to urban and ecological systems. • Supports SDGs 6, 9, 11 & 12.

Source: Constructed by author

Table 6: Community

Community (Equity, Wellbeing, and Participation)	
Rationale	Most sustainability frameworks prioritise environmental performance over equity and inclusivity, leading to buildings that achieve efficiency but lack meaningful social and cultural value. Embedding community perspectives enhances resilience, fosters cultural relevance, and improves long-term user acceptance and stewardship. Integrating wellbeing and participation ensures that architecture contributes to human-centred and equitable environments.
Scope and Methodology	• Integrate community engagement from the earliest design stages through participatory processes that include diverse and vulnerable stakeholders. • Assess accessibility, cultural identity, health outcomes, and equity indicators alongside technical and environmental performance. • Collaborate with local authorities, residents, and user groups to establish shared priorities, build trust, and ensure long-term accountability. • Apply Social Value Frameworks and Social Return on Investment to quantify and communicate community benefits and wellbeing impacts.
Design Strategies	• Design inclusive, universally accessible spaces, meeting diverse physical and cultural needs. • Integrate local narratives and identity to reinforce belonging and cultural continuity. • Prioritise indoor environmental quality such as daylight, acoustics, and ventilation to promote wellbeing. • Provide shared flexible spaces, supporting interaction, collaboration, and social resilience. • Apply biophilic and restorative design principles to enhance mental health and connection to nature. • Implement participatory workshops and co-design approaches to ensure outcomes reflect collective community needs.
Metrics and Deliverables	• **Metrics:** Accessibility scores, post-occupancy satisfaction levels, indoor environmental quality benchmarks, participation rates, representation of cultural identity in spatial outcomes, and energy poverty indicators (e.g., households spending >10% of income on energy). • **Deliverables:** Community and Wellbeing Report, Stakeholder Engagement Log, Post-Occupancy Social Impact Assessment, and summary of measurable social outcomes.
Anticipated Benefits	• Enhanced health, wellbeing, and psychological comfort. • Greater inclusivity and cultural resonance within built environments. • Stronger alignment between design intent and user experience. • Reduced social inequities through participatory and inclusive processes. • Improved community resilience and ownership supporting social cohesion. • Integration of social equity and environmental sustainability, fostering regenerative, human-centred architecture. • Supports SDGs 3, 5, 10 & 11.

Source: Constructed by author

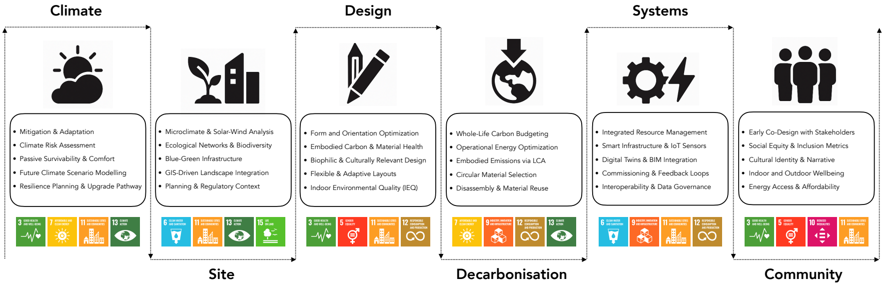

Figure 1: SCDA Framework Infographic
Source: Constructed by author

DISCUSSION

As discussed earlier, certification systems have played an important role in formalising technical benchmarks, but their checklist-driven structures continue to under-represent resilience, adaptation, and equity. Post-occupancy studies confirm inconsistencies, with some certified buildings underperforming relative to expectations. The SCDA moves beyond these limitations:

- *Climate* integrates mitigation and adaptation;
- *Site* addresses ecological and microclimatic contexts;
- *Design* prioritises wellbeing, materiality, and adaptability;
- *Decarbonisation* incorporates embodied and operational carbon;
- *Systems* emphasise interoperability, monitoring, and circularity; and
- *Community* embeds equity and participatory design.

Collectively, they close persistent gaps in current frameworks and directly target the performance gap between predicted and actual outcomes. At the same time, while the built environment is central to SDG achievement, fewer than 20% of green building attributes explicitly address SDG targets. The SCDA collectively supports multiple SDGs, thereby embedding the built environment firmly within global sustainability priorities.

Existing frameworks largely reflect compliance-driven paradigms, whereas the SCDA integrates lifecycle, resilience, and community dimensions to support regenerative and adaptive practice. This approach reflects circular economy principles and post-Anthropocene discourse, shifting architecture from harm reduction towards ecological and social restoration while addressing the performance gap. The framework also provides architects, engineers, and policy-makers with a structured tool for early-stage decision-making. Unlike certification systems that verify performance late in design or construction, it embeds climate, site, design, carbon, systems, and community considerations at the outset, reducing revisions, improving performance, and strengthening stakeholder trust. Its universality ensures flexibility across international and local contexts, as it is not tied to any single regional standard. Furthermore, Eichner and Ivanova (2020) outline eco-anthropocentric principles integrating ecological sustainability with human comfort and cultural sensitivity, but their model remains largely descriptive. The SCDA extends these conceptual foundations by operationalising them into six domains, each with strategies, metrics, and deliverables. This bridges theory and practice, advancing climate-conscious design from philosophy to methodology.

CONCLUSIONS

This paper argues that accelerating climate impacts and the limits of compliance-based certification systems demand a new approach to sustainable architecture. While tools such as LEED and BREEAM advanced environmental reporting, they remain fragmented, with insufficient attention to adaptation, equity, lifecycle impacts, and systemic integration. The SCDA responds to these gaps by embedding sustainability goals at the earliest project stages. The framework shifts from checklists to an holistic approach that incorporates environmental and social priorities, links to SDGs, and offers measurable indicators and outcomes for design teams. Although conceptual, the framework provides practical direction for architects, engineers, and policy-makers. Future research should validate effectiveness through case studies, performance data, and stakeholder engagement, while exploring its adaptability to diverse cultural and regional contexts. Digital integration, including BIM, digital twins, and material passports, will further strengthen implementation and scalability. By embedding resilience, equity, and systemic thinking into early design, the SCDA framework repositions architecture as an active agent in addressing planetary challenges. It offers a pathway towards making buildings and cities sustainable, regenerative, inclusive, and resilient in the post-2030 era.

REFERENCES

Amiri, A., Ottelin, J. and Sorvari, J. (2019): Are LEED-Certified Buildings Energy-Efficient in Practice? *Sustainability*, Vol. 11, No. 6, p.1672. Available at: https://doi.org/10.3390/su11061672

Anyanya, D., Paulillo, A., Fiorini, S. and Lettieri, P (2025): Evaluating sustainable building assessment systems: A comparative analysis of GBRS and WBLCA. *Frontiers in Built Environment*, Vol. 11, p.1550733. Available at: https://doi.org/10.3389/fbuil.2025.1550733

Ascione, F., De Masi, R.F., Mastellone, M. and Vanoli, G.P (2022): Building rating systems: A novel review about capabilities, current limits and open issues. *Sustainable Cities and Society*, Vol. 76, p.103498. Available at: https://doi.org/10.1016/j.scs.2021.103498

Bacheva, T.S. and Raposo Grau, J.F. (2025): Embodied Impacts in Buildings: A Systematic Review of Life Cycle Gaps and Sectoral Integration Strategies. *Buildings*, Vol. 15, No. 10, p.1661. Available at: https://doi.org/10.3390/buildings15101661

Bronstein, B. (2020): Development of discourse and criteria in green building. *Pitzer Senior Theses*, 100. Available at: https://scholarship.claremont.edu/pitzer_theses/100

Building Research Establishment (BRE) (2022): *BREEAM International New Construction 2016 (Technical Manual, SD233)*. Building Research Establishment. Available at: https://hbreavis.com/wp-content/uploads/2017/06/BREEAM-International-New-Construction-2016.pdf Accessed: 13 September 2025. 454pp.

Butt, A.N. (2025): Advancing Social Sustainability in BREEAM New Construction Certification Standards. *Standards*, Vol. 5, No. 1, p.8. Available at: https://doi.org/10.3390/standards5010008

Eichner, M. and Ivanova, Z. (2020): Climate change and Eco-Anthropocentric approach to architectural and Urban Planning. *IOP Conference Series: Materials Science and Engineering*, Vol. 953, No. 1, p.012055. IOP Publishing. Available at: https://doi.org/10.1088/1757-899X/953/1/012055

Goubran, S. and Cucuzzella, C. (2019): Integrating the Sustainable Development Goals in Building Projects. *Journal of Sustainable Research*, Vol. 1, No. 2, p.e190010. Available at: https://doi.org/10.20900/jsr20190010

Iacobuță, G.I., Höhne, N., van Soest, H.L. and Leemans, R. (2021): Transitioning to Low-Carbon Economies under the 2030 Agenda: Minimizing Trade-Offs and Enhancing Co-Benefits of Climate-Change Action for the SDGs. *Sustainability*, Vol. 13, No. 19, p.10774. Available at: https://doi.org/10.3390/su131910774

International Energy Agency (IEA) (2021): *Buildings Tracking Sector Progress*. Available at: https://www.iea.org/energy-system/buildings Accessed: 28 September 2021.

Iwuanyanwu, O., Gil-Ozoudeh, I., Okwandu, A.C. and Ike, C.S. (2024): Cultural and social dimensions of Green Architecture: Designing for sustainability and community well-being. *International Journal of Applied Research in Social Sciences*, Vol. 6, No. 8, pp.1951-1968. Available at: https://doi.org/10.51594/ijarss.v6i8.1477

Jayasanka, T.A.D.K., Darko, A., Edwards, D.J., Chan, A.P. and Jalaei, F. (2024): Automating building environmental assessment: A systematic review and future research directions. *Environmental Impact Assessment Review*, Vol. 106, p.107465. Available at: https://doi.org/10.1016/j.eiar.2024.107465

Kristoffersen, A.E., Schultz, C.P. and Kamari, A. (2024): A critical comparison of concepts and approaches to social sustainability in the construction industry. *Journal of Building Engineering*, Vol. 91, p.109530. Available at: https://doi.org/10.1016/j.jobe.2024.109530

Larsen, V.G., Tollin, N., Sattrup, P.A., Birkved, M. and Holmboe, T. (2022): What are the challenges in assessing circular economy for the built environment? A literature review on integrating LCA, LCC and S-LCA in life cycle sustainability assessment, LCSA. *Journal of Building Engineering*, Vol. 50, p.104203. Available at: https://doi.org/10.1016/j.jobe.2022.104203

Latiolais, A., Mohler, R., Plotnikova, S., Yoachim, A., Davidson, S., Harrison, A., Hong, Z. and Crisman, P. (2021): Design for Climate Action. *Semantic Scholar*. Available at: https://www.semanticscholar.org/paper/DESIGN-FOR-CLIMATE-ACTION-Latiolais-Mohler/d9cf9cefddefd30cee76697fbd7d01b6377b9412

Leach, M., Reyers, B., Bai, X., Brondizio, E.S., Cook, C., Díaz, S., Espindola, G., Scobie, M., Stafford-Smith, M. and Subramanian, S.M. (2018): Equity and sustainability in the Anthropocene: a social-ecological systems perspective on their intertwined futures. *Global Sustainability*, Vol. 1, p.e13. Available at: https://doi.org/10.1017/sus.2018.12

Li, H., Li, C., Skitmore, M., He, T. and Jiang, T. (2022): The post-occupancy dilemma in green-rated buildings: a performance gap analysis. *Journal of Green Building*, Vol. 17, No. 3, pp.259-275. Available at: https://doi.org/10.3992/jgb.17.3.259

Looman, R. (2017): Climate-responsive design: A framework for an energy concept design-decision support tool for architects. *Architecture and the Built Environment, Vol. 1, pp.1-282*. Available at: https://doi.org/10.59490/abe.2017.1.1643

Lotfy, W. (2023): Integration of Biophilic Design Principles with Sustainable Development Goals (SDGs). *Arts and Architecture Journal, Vol. 4, No. 1, pp.252-272*. Available at: https://doi.org/10.21608/aaj.2024.263709.1052

Mannucci, S. (2025): Beyond sustainability: Paradigms for Complexity and Resilience in the Built Environment. *Urban Science*, Vol. 9, No. 6, p.212. Available at: https://doi.org/10.3390/urbansci9060212

Mattinzioli, T., Sol-Sánchez, M., Moreno, B., Alegre, J. and Martínez, G. (2020): Sustainable building rating systems: A critical review for achieving a common consensus. *Critical Reviews in Environmental Science and Technology*, Vol. 51, No. 5, pp.512-534. Available at: https://doi.org/10.1080/10643389.2020.1732781

McArthur, J.J. and Powell, C. (2020): Health and wellness in commercial buildings: Systematic review of sustainable building rating systems. *Building and Environment*, Vol. 171, p.106635. Available at: https://doi.org/10.1016/j.buildenv.2019.106635

Mensah, J. (2021): Social Sustainability: A Dwarf among giants in the Sustainable Development Pillars? *Asian Journal of Management, Vol. 12, No. 2, pp.127-138*. Available at: https://doi.org/10.52711/2321-5763.2021.00019

Oghenejabor, D.O., Ikoro, M.A., Vwioko, I.R. and Umukoro, B. (2025): Designing of buildings in the age of the Anthropocene: Is environmental sustainability the answer? *World Journal of Advanced Engineering Technology and Sciences*, Vol. 16, No. 3, pp.1953-1965. Available at: https://doi.org/10.30574/wjaets.2025.15.2.0757

Piętocha, A. (2024): The BREEAM, the LEED and the DGNB certifications as an aspect of sustainable development. *Acta Scientiarum Polonorum. Architectura*, Vol. 23, pp.121-133. Available at: https://doi.org/10.22630/aspa.2024.23.9

Rostami, R. (2025): A Review of Green Building Certification Systems through the Lens of Sustainable Architecture. *Journal of Design Studio*, Vol. 7, No. 1, pp.163-176. Available at: https://doi.org/10.46474/jds.1691673

Royal Institute of British Architects (RIBA) (2021): *The RIBA 2030 Climate Challenge*. Royal Institute of British Architects. Available at: https://www.architecture.com/about/policy/climate-action/2030-climate-challenge Accessed: 13 September 2025.

Sesana, M.M. and Dell'Oro, P. (2024): Sustainability and Resilience Assessment Methods: A Literature Review to Support the Decarbonization Target for the Construction Sector. *Energies,* Vol. *17, No.* 6, p.1440. Available at: https://doi.org/10.3390/en17061440

Shuttleworth, A. and MacAskill, K. (2021): Net zero adaptation—a review of Built Environment Sustainability Assessment Tools. *Environmental Research: Infrastructure and Sustainability*, Vol. 1, No. 2, p.023002. Available at: https://doi.org/10.1088/2634-4505/ac1c5e

Suzer, O. (2015): A comparative review of environmental concern prioritization: LEED vs other major certification systems. *Journal of Environmental Management*, Vol. 154, pp.266-283. Available at: https://doi.org/10.1016/j.jenvman.2015.02.029

US Green Building Council (USGBC) (2023): *LEED v5 for Building Design and Construction*. U.S. Green Building Council. Available at: https://www.usgbc.org/leed Accessed: 13 September 2025.

Wamsler, C., Osberg, G., Osika, W., Herndersson, H. and Mundaca, L. (2021): Linking internal and external transformation for sustainability and climate action. *Global Environmental Change*, Vol. 71, p.102373. Available at: https://doi.org/10.1016/j.gloenvcha.2021.102373

Wen, B., Musa, S.N., Onn, C.C., Ramesh, S., Liang, L., Wang, W. and Ma, K. (2020): The role and contribution of Green Buildings on Sustainable Development Goals. *Building and Environment*, Vol. 185, p.107091. Available at: https://doi.org/10.1016/j.buildenv.2020.107091

Whole Building Design Guide (2023): *Whole Building Design Guide (WBDG)*. [online] Available at: https://www.wbdg.org Accessed: 16 September 2025.

Wouda Kuipers, J. and Korwatanasakul, U. (2024): Interlinkages Between Climate Action and the Sustainable Development Goals. *SAGE Open*, Vol. 14, No. 3, p.21582440241267354. Available at: https://doi.org/10.1177/21582440241267354

Zhong, W., Schröder, T. and Bekkering, J. (2022): Biophilic Design in architecture and its contributions to health, well-being, and sustainability. *Frontiers of Architectural Research*, Vol. 11, No. 1, pp.114-141. Available at: https://doi.org/10.1016/j.foar.2021.07.006

Zimmermann, R.K., Skjelmose, O., Jensen, K.G., Jensen, K.K. and Birgisdottir, H. (2019): Categorizing Building Certification Systems According to the Definition of Sustainable Building. *IOP Conference Series: Materials Science and Engineering*, Vol. 471, No. 9, p.092060. IOP Publishing Available at: https://doi.org/10.1088/1757-899X/471/9/092060

BIOGRAPHY

Sara Elhussein is a chartered Architect and Sustainability Lead with 10+ years' experience across Africa, the Middle East, and Europe. Sara has an MSc in Environmental Design and Engineering from University College London, is a juror for the RIBA Middle East Awards 2025, and a key member of the Sudan Heritage Preservation Council. She is an expert in climate-responsive, parametric design, AI, environmental modelling, retrofit, circular economy, and LCA. Sara founded I Design Studio and the Sudan Arts & Architecture Foundation. Her portfolio includes major projects such as the Qiddiya Stadium (KSA) and Aylesham Centre Redevelopment (UK). She has won architectural competitions, including designing the Sudan Pavilion at Expo 2020 Dubai, and curated Sudan's first Venice Architecture Biennale Pavilion. Sara is the author of the 'Sustainable Rebuilding and Recovery Framework' chapter in WASD's book *From War to Sustainable Development*. Her current research focuses on climate-conscious design for sustainable architecture beyond the Agenda 2030.

