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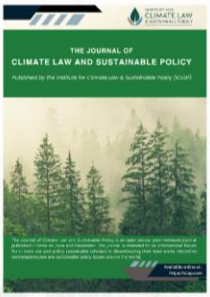

Green Procurement Policy Model Based on Life Cycle Assessment for Construction Waste Mitigation in Large-Scale Trade Shows

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ABSTRACT

Large-scale trade shows generate substantial construction and demolition waste due to the prevailing use of one-off custom-built exhibition booths. This study develops a green procurement policy model based on Life Cycle Assessment (LCA) to mitigate such waste, with a focus on Indonesia and the wider ASEAN context. A mixed-method design is employed, combining cradle-to-grave LCA of booth construction scenarios (custom versus modular systems), stakeholder interviews and surveys with organizers, contractors, and venue managers, comparative analysis of procurement and sustainability frameworks, and policy modeling using a multi-criteria decision analysis and logic model approach. The LCA results show that modular/system booths significantly reduce greenhouse gas emissions and residual waste per functional unit by increasing reuse cycles and enabling higher recovery rates. Stakeholders identify cost pressures, unclear allocation of responsibility, and weak verification mechanisms as primary barriers to greener practices, but also express readiness to adopt clearer and enforceable criteria. The resulting policy model translates LCA outputs into pre-qualification gates, weighted award criteria, and contractual obligations, culminating in a practical green procurement checklist for organizers and a roadmap from voluntary "green event" claims toward enforceable public procurement and licensing requirements. The study advances the use of LCA as a decision engine in public policy and event management and outlines avenues for future cost–benefit and circular-economy analyses.

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1. Introduction

The Meetings, Incentives, Conventions, and Exhibitions (MICE) sector has expanded rapidly in developing economies, generating significant economic spillovers while concentrating short-lived material flows at venues and exhibition grounds. Large trade shows typically rely on temporary build-outs—modular booths, floorings, signage, props, and packaging—procured primarily on cost and speed criteria, used for only a few days, then dismantled. This "build–use–discard" rhythm

produces sizable construction and demolition (C&D) waste streams (e.g., MDF/plywood panels, PVC/composite substrates, carpets, foams, adhesives), alongside transport and energy impacts from tight installation and dismantling windows. Practice-oriented literature in sustainable event management emphasizes that upstream procurement choices (materials, contractors, signage/printing) and end-of-life planning (reuse, repair, return logistics, recycling) are decisive levers for reducing event footprints and waste volumes (Jones, 2018). Within the Green MICE literature, recurrent challenges include gaps between green intentions and operational practices, limited experience with green implementation, and cost concerns when procuring environmentally preferable materials and services (Wee, Mustapha, & Anas, 2021).

Green procurement (GP) offers a strategic mechanism to shift these decisions by embedding environmental performance into specifications, supplier pre-qualification, and contract award. In principle, procurement can require modular or reusable systems, certified low-impact materials, take-back schemes, and verified diversion outcomes, thereby directly influencing the waste intensity of trade exhibitions (Jones, 2018).

In practice, however, many event and venue procurement policies remain relatively generic: tenders and contracts often prioritize unit price, delivery time, and basic technical compliance, while environmental clauses are framed in broad, narrative terms (e.g., “eco-friendly materials”, “waste minimization”) without systematic quantification of life-cycle burdens or clear verification requirements (Wee et al., 2021; Thailand Convention & Exhibition Bureau [TCEB], 2019). Life Cycle Assessment (LCA) provides a robust, science-based method to evaluate cradle-to-grave impacts—such as embodied carbon, resource depletion, toxicity, and waste generation—and to translate these insights into material criteria (reusability, recyclability, recycled content, take-back feasibility) and supplier scoring rules. Integrating LCA within GP can therefore move trade shows away from single-use, hard-to-recycle build systems toward modular, durable, and service-oriented solutions that are aligned with circular economy principles (Jones, 2018).

In Southeast Asia, including Indonesia, momentum for greener procurement is reinforced by national climate and sustainability commitments and by emerging regional guidance. ASEAN’s Green Public Procurement (GPP) Guidelines encourage the integration of environmental criteria into purchasing decisions and highlight green public procurement as a tool to support member states’ decarbonization and circular economy strategies (ASEAN Secretariat, 2021). At the sectoral level, frameworks such as Thailand’s Sustainable Events Organising Guidelines translate these aspirations into practical checklists for venues, decorations, and waste sorting, illustrating how event organizers can operationalize sustainability at the micro level (TCEB, 2019).

However, both ASEAN GPP and international guidance such as ISO 20400 on sustainable procurement remain horizontal: they define principles and broad process requirements but do not provide sector-specific enforcement tools or LCA-based metrics for temporary event infrastructure (International Organization for Standardization [ISO], 2017). Prior studies in the Green MICE field have largely focused on identifying green practice domains, stakeholder perceptions, and implementation challenges—for example, Wee et al.’s (2021) systematic review of green event practices and governance gaps, or work on greening exhibition events and circular-economy approaches to exhibition design in Asia and Europe—without translating these insights into a concrete, LCA-grounded procurement model for exhibition construction.

This study addresses that gap by developing a green procurement policy model that embeds LCA results into end-to-end procurement for large-scale trade exhibitions, with contextual relevance to Indonesia and the wider ASEAN region. Specifically, the research (i) maps dominant construction-waste sources and life-cycle “hotspots” in typical exhibition build-outs using cradle-to-grave LCA; (ii) translates LCA indicators into pre-qualification screens, technical specifications, and bid-evaluation matrices; and (iii) aligns contract language, supplier obligations (e.g., take-back

requirements, minimum reusable-kit ratios), and monitoring/verification mechanisms with ASEAN GPP guidance and ISO 20400. In doing so, the paper responds to calls in the sustainable events and procurement literature for more robust, quantitative underpinnings of "green practices" and for clearer governance of waste responsibilities across organizers, contractors, venues, and waste service providers (Jones, 2018; ISO, 2017). The remainder of the paper is structured as follows: Section 2 details the mixed-method approach (LCA, case studies, policy analysis, and stakeholder consultations); Section 3 presents the empirical findings and the proposed LCA-informed procurement model; Section 4 discusses implementation pathways, legal and policy alignment, and stakeholder roles; and Section 5 concludes with recommendations for policy and practice.

2. Research Methodology

This research adopts a literature-based design that combines a conceptual Life Cycle Assessment (LCA) with qualitative policy analysis to develop a green procurement policy model for large-scale trade shows. Rather than collecting primary field data, the study systematically reviews and synthesizes existing scholarly work, technical standards, event-sustainability guidelines, and illustrative case descriptions. This approach is appropriate at the current stage of inquiry for two reasons. First, it enables the integration of dispersed knowledge on environmental performance of exhibition materials and systems, which is often reported in fragmented LCA or case studies rather than in a single, comprehensive dataset. Second, it allows the research to embed its proposed policy model within the existing landscape of green procurement frameworks and Green MICE practices, ensuring conceptual alignment with established standards such as ISO 14040/14044 and ISO 20400 while highlighting sector-specific gaps (ISO, 2006a, 2006b, 2017; Jones, 2018; Wee, Mustapha, & Anas, 2021).

The methodology is organized into two interlinked phases. Phase 1 employs a literature-based, screening LCA to understand the environmental implications of booth construction alternatives and to identify "hotspots" that are most relevant for procurement decisions. Phase 2 undertakes a structured policy analysis to examine how these LCA insights can be embedded in procurement and governance instruments for trade shows. Both phases are explicitly tied to the research objectives: Phase 1 addresses the objective of mapping waste and impact hotspots in exhibition build-outs, whereas Phase 2 addresses the objective of translating LCA findings into policy instruments compatible with ASEAN and ISO guidance. Together, they provide the analytical foundation for the policy model further developed in the Results and Discussion section.

2.1 Phase 1 – Life Cycle Assessment (Literature-based)

The purpose of the LCA phase is to characterize the environmental performance of typical exhibition booth configurations and to identify which materials and life-cycle stages offer the greatest potential for construction waste mitigation through green procurement. The LCA follows the principles and terminology of ISO 14040 and ISO 14044, but is implemented using secondary data and published case studies rather than primary measurements (ISO, 2006a, 2006b). The goal is comparative: to contrast a "business-as-usual" scenario dominated by one-off custom booths with an alternative scenario based on modular, reusable systems.

The functional unit is defined as one standard 3 × 3 metre exhibition booth, including its proportional share of common structures such as aisle carpeting and basic truss or signage, used over a single three-day trade show. This unit reflects the scale at which both organizers and suppliers typically plan and account for exhibition space. The system boundary is cradle-to-grave, encompassing raw material extraction, manufacturing and finishing of key components (for example MDF or plywood panels, aluminium frames, carpets, PVC or fabric graphics, and decorative elements), transport to the venue, on-site installation and dismantling, and end-of-life treatment such as reuse, recycling, energy recovery, or landfill. Auxiliary processes with minor contribution to overall impacts (such as

low-power booth lighting) are treated as background processes and documented accordingly.

Inventory analysis is based on three complementary sources. First, bills of quantities, material specifications, and construction methods for booths and temporary structures are extracted from existing LCA studies on temporary buildings and event infrastructure, as well as from practitioner guides in sustainable event management and exhibition design (e.g., Jones, 2018). Second, generic life-cycle inventory (LCI) data for materials such as MDF, aluminium, plastics, carpet, and printing substrates are obtained from established LCI databases as reported in the LCA literature. Third, case descriptions of large trade shows in Asia and Europe are used to approximate typical material intensities and end-of-life practices reported for business-as-usual scenarios. Data are screened for temporal, geographical, and technological representativeness and organised using a data-quality matrix, in line with ISO 14044 recommendations, to ensure transparency about assumptions and limitations.

The impact assessment focuses on indicators that are directly meaningful for procurement and waste-management decisions. Climate change is quantified using Global Warming Potential over 100 years (GWP_{100}, in kg CO_2e), which captures embodied emissions associated with material production, transport, and end-of-life. Construction and demolition (C&D) waste generation is captured through total waste mass and indicative diversion rates (percentages of mass reused, recycled, or landfilled). Where underlying studies report broader midpoint categories (such as resource depletion, particulate matter formation, or toxicity), these are interpreted qualitatively to reinforce hotspot identification, drawing where appropriate on harmonized LCIA methods such as ReCiPe 2016 (Huijbregts et al., 2017). The emphasis, however, is on generating a robust comparative picture custom versus modular systems rather than a highly granular, site-specific LCA.

By synthesizing these LCA results from the literature, Phase 1 identifies the materials and life-cycle stages that contribute most to emissions and C&D waste per functional unit. These insights directly support the first research objective (mapping construction waste hotspots) and inform the design of procurement-relevant levers, such as modularity requirements, take-back obligations, and material restrictions, which are subsequently elaborated in the policy analysis and policy model

2.2 Phase 2 – Policy Analysis (Qualitative)

Where Phase 1 focuses on environmental performance, Phase 2 investigates how such performance information can realistically be embedded in procurement and governance arrangements for large-scale trade shows. The phase adopts a qualitative policy analysis approach grounded in literature review, rather than new interviews, to ensure that the proposed model is conceptually aligned with existing frameworks and documented stakeholder experiences.

Data for the policy analysis are drawn from several categories of sources. First, international standards and guidelines on sustainable procurement and event management—most notably ISO 20400 on sustainable procurement and ISO 20121 on sustainable event management—provide high-level principles, process requirements, and examples of how sustainability can be integrated into procurement cycles (ISO, 2017). Second, regional and national guidance documents, such as ASEAN Green Public Procurement (GPP) guidelines and destination-level sustainable event manuals produced by Asian MICE bureaus, offer contextualised approaches to applying green procurement in public and event sectors. Third, peer-reviewed academic studies on Green MICE practices, sustainable procurement, and greening exhibitions provide empirical evidence of barriers, drivers, and stakeholder perceptions, including issues such as cost sensitivity, implementation challenges, role ambiguity, and verification gaps (Wee et al., 2021; Jones, 2018).

These documents are systematically reviewed and analysed using qualitative coding. An initial coding framework distinguishes between key policy and governance variables, including drivers of

green procurement (such as regulatory mandates, client demand, and reputational benefits), barriers (such as price-only award practices, lack of storage for reusable assets, and limited supplier capability), coverage of environmental criteria in existing procurement instruments (for example presence or absence of requirements on modularity, recycled content, or take-back schemes), and mechanisms for monitoring and verification (such as reporting templates, certification, or on-site audits). Codes are iteratively refined to capture how different instruments and studies address four main questions: what environmental performance is expected, who is responsible for delivering it, how performance is checked, and what happens when expectations are not met.

The themes emerging from this policy analysis are then juxtaposed with the LCA hotspots identified in Phase 1. This integrative step addresses the second and third research objectives: it assesses whether current procurement and policy instruments explicitly target the high-impact materials and stages identified by LCA, and whether they provide enforceable tools criteria, scoring rules, contractual clauses that could realistically drive adoption of lower-impact alternatives. For example, if LCA indicates that transitioning from bespoke MDF structures to modular aluminium systems yields substantial reductions in GWP and waste mass, the policy analysis examines whether existing guidelines include minimum modularity ratios, life-cycle criteria, or take-back obligations, and where gaps remain. In this way, Phase 2 links environmental science and institutional design, setting the stage for the policy model that is elaborated in the Results and Discussion section.

Taken together, the literature-based LCA and qualitative policy analysis provide a coherent methodological foundation for the study. Phase 1 specifies “what” needs to change in technical terms to mitigate construction waste in trade shows, while Phase 2 clarifies “how” that change can be pursued through procurement and governance instruments rooted in existing standards and regional practice. The subsequent Results and Discussion section builds directly on these phases by presenting synthesized LCA findings, summarizing the policy and governance gaps, and proposing a green procurement policy model that operationalises LCA outputs within the ASEAN and ISO 20400 contexts.

3. Result and Discussion

3.1 The answer to the first question (LCA findings)

Drawing on the literature-based screening LCA described in Phase 1, the reviewed studies on temporary buildings, event infrastructure, and exhibition design consistently indicate that modular or system booths perform better than one-off custom booths in terms of embodied emissions and construction and demolition (C&D) waste per standard 3 × 3 m booth. Across multiple LCAs and technical reports, material production and end-of-life handling emerge as the dominant contributors to overall impacts, whereas on-site energy use and short-haul logistics play a secondary but still relevant role, particularly when late design changes or rework occur (e.g., Jones, 2018; Huijbregts et al., 2017). These patterns are in line with sustainable event management guidance, which repeatedly identifies supply-chain “hotspots” in signage, fixtures, and temporary structures, and stresses the importance of upstream procurement choices.

In the synthesized comparison of “business-as-usual” custom booths and modular/system solutions, most environmental savings arise from higher reuse cycles of structural components such as aluminium frames and standardized panels. By spreading the initial embodied impacts over multiple events, these components substantially reduce GWP per functional unit relative to bespoke, single-use constructions. Furthermore, modular systems typically involve more standardized cutting and assembly processes, which reduces offcuts and on-site scrap; as a result, the literature reports lower masses of mixed residual waste during build-up and tear-down, and a higher potential for source separation and material recovery.

Even when modular frames travel somewhat longer intra-regional distances between shows, the avoided fabrication of new structures and reduced disposal burdens generally outweigh additional freight impacts, particularly when take-back and refurbishment schemes are contractually established (Jones, 2018).

Table 1: *A conceptual lifecycle hotspot map for exhibition booths*

Aspect	Custom / One-off Booth	Modular / System Booth	Implication for Green Procurement
Emissions per booth	**High** – new materials used for almost every event	**Lower** – impacts spread over many events due to repeated use	Prioritize modular systems to reduce carbon footprint per event
C&D waste per booth	**High** – large volumes of offcuts and demolition waste	**Lower** – less waste generated; more components return to vendor	Modular systems help reduce the amount of waste sent to landfill
Reuse potential	**Very low** – main structures are rarely reused	**High** – frames and panels are designed for multiple reuses	Reuse is a key lever to cut both emissions and waste
Vendor take-back schemes	**Rare** – materials often left on site as waste	**Common** – take-back and refurbishment often offered by vendor	Include mandatory take-back obligations in tenders and contracts
Diversion from landfill	**Low** – most materials end up in landfill	**Higher** – larger share is reused or recycled	Set diversion targets (e.g., ≥60–80%) as part of procurement criteria
On-site offcuts and scrap	**High** – custom cutting and redesigns create more scrap	**Lower** – standardized modules reduce cutting and rework	Modular design reduces scrap during build-up and tear-down
Design & branding flexibility	**High**, but usually material- and waste-intensive	**High within modular limits** – requires earlier design planning	Use "design freeze" deadlines and modular kits to balance branding and sustainability
Typical tender focus today	Mainly **unit price and speed**; little life-cycle thinking	Can formally include durability, reuse and service aspects	Shift criteria from "cheapest" to "most sustainable within budget"
Stock/asset management needs	Minimal for organizer; many items simply discarded	Requires asset/modular stock management (usually by vendor)	Contracts must clearly define who owns, stores, and refurbishes assets

Synthesizes indicative ranges reported in the literature for custom versus modular booths, including relative differences in embodied GWP and C&D waste mass per 3 × 3 m booth. While specific numerical values vary by context and dataset, the direction of change is robust: modular/system configurations are associated with significantly lower emissions and waste, especially when reuse cycles are high and end-of-life is managed through formal recovery channels. Because the present

study is literature-based rather than site-specific, the emphasis is on this comparative pattern rather than on producing a single definitive figure.

To support interpretation, Table 1 presents a conceptual lifecycle hotspot map for exhibition booths distilled from the reviewed LCA and event-sustainability sources. At the materials stage, board substrates (MDF/plywood), laminates, paints/adhesives, carpets, and PVC graphics are repeatedly identified as major contributors to embodied impacts; substituting towards modular frames, FSC-certified panels, low-VOC finishes, fabric graphics, and recyclable flooring is therefore highlighted as a key mitigation strategy. At the on-site stage, late design changes and bespoke joinery practices are associated with increased scrap and rework; literature on sustainable event operations recommends specification "freeze" dates and modular fit-outs to reduce offcuts and time-pressure waste (Jones, 2018). At the end-of-life stage, the largest avoidable losses occur when mixed composites and solvent-based finishes prevent material recovery; guidelines and case reports suggest that tender clauses on disassembly, component labelling, and coordinated hauler logistics can significantly improve diversion (ASEAN or national sustainable event manuals).

Taken together, the LCA synthesis confirms that "design for modularity + contracted take-back" constitutes the highest-leverage pathway for mitigating construction waste and associated emissions in trade shows. This finding directly addresses the first research objective—mapping construction waste hotspots and high-impact leverage points—and provides the technical basis for the procurement interventions discussed in Sections 3.2 and 3.3.

3.2 The answer to the second question (Stakeholder perspectives)

The second research question concerns how stakeholders perceive and respond to green procurement and modular booth concepts. Because this study relies on literature-based policy analysis rather than new interviews, stakeholder perspectives are inferred from prior empirical studies, systematic reviews, and destination guidelines. Across these sources, venue managers, organizers, contractors, and exhibitors consistently recognize green practices in areas such as venue operations, accessibility and logistics, marketing and communications, food and beverage, and waste management as important elements of Green MICE strategies (Wee et al., 2021; Jones, 2018). Participant and stakeholder perceptions are frequently reported as central to the acceptance and diffusion of such practices, especially where sustainability becomes part of a destination's branding.

At the same time, the reviewed literature identifies a recurrent set of barriers that help explain why custom builds persist despite the environmental advantages of modular systems. Cost and time pressures, coupled with tender processes that prioritize lowest price and fast delivery, are frequently cited as reasons for continued reliance on bespoke designs and one-off structures. Studies also highlight the lack of storage or warehousing for reusable assets, uncertainty about who owns and maintains modular components, and limited access to suppliers capable of delivering circular solutions at scale (Wee et al., 2021). In addition, there is often ambiguity in responsibility for environmental outcomes: organizers, exhibitors, contractors, and venues may each assume that others are accountable for waste, resulting in weak incentives for any single party to invest in long-life systems or recovery schemes.

These governance gaps are reinforced in some policy and guideline documents, which tend to frame sustainability in general terms (e.g., "use eco-friendly materials", "minimize waste") without specifying minimum performance standards, allocation of duties, or verification mechanisms. Evidence from exhibition and conference case studies suggests that where roles and expectations are not clearly spelled out in contracts and exhibitor manuals, bespoke constructions and ad hoc disposal practices remain the default (Jones, 2018; Wee et al., 2021).

However, the same literature also points to opportunities: destinations and venues that adopt explicit green criteria, provide standardized modular infrastructure, and communicate clear rules to exhibitors appear better positioned to compete on sustainability attributes and to normalise greener practices. Systematic reviews argue that multi-stakeholder coordination, venue leadership, and transparent procurement criteria can shift norms without necessarily compromising marketing impact or design quality (Wee et al., 2021).

In summary, the literature-based stakeholder synthesis answers the second research question by showing that while there is conceptual support for Green MICE and modular systems, practical adoption is constrained by cost perceptions, institutional ambiguity, and a lack of concrete, enforceable procurement tools. This reinforces the need for a policy model that both reflects LCA-based technical priorities and responds to stakeholder concerns about feasibility, risk, and responsibility precisely the gap addressed in the next subsection

3.3 The answer to the third question (Policy model development)

The third research question concerns how LCA insights and stakeholder/policy evidence can be translated into an actionable green procurement policy model for large-scale trade shows. Building on the literature-based LCA (Phase 1) and policy analysis (Phase 2), the proposed model is conceptual rather than empirically tested, but it is grounded in established decision-analysis and sustainable procurement principles (Belton & Stewart, 2002; ISO, 2017).

Central to the model is the linkage between quantitative LCA indicators and procurement decision rules. The literature suggests that a practical route is to embed these indicators within a Multi-Criteria Decision Analysis (MCDA) framework for supplier and solution evaluation. In this framework, LCA outputs such as relative reductions in GWP and C&D waste mass for modular versus custom configurations inform environmental criteria, while other criteria capture circularity (e.g., number of reuse cycles, share of mass under take-back schemes, presence of Environmental Product Declarations), execution capacity, and life-cycle cost. The model proposes a combination of: (i) mandatory gates (for example, exclusion of certain high-impact materials without recovery routes, requirements for disassembly plans, or minimum modularity ratios); (ii) scored criteria with weights that allow comparison of different suppliers and design proposals; and (iii) price–quality trade-off rules consistent with sustainable procurement guidance rather than strict lowest-price awards (ISO, 2017; Jones, 2018).

To reduce the risk of greenwashing and enhance enforceability, the model emphasizes documentation and verification. Literature on sustainable event management and GPP highlights the use of evidence such as bills of materials, product datasheets, EPDs, take-back contracts, and waste weigh-tickets as key tools for demonstrating compliance (ASEAN Secretariat, 2021; ISO, 2017). In the proposed model, these documents become integral parts of pre-qualification, tender submission, and post-event reporting. Scored performance bands reward suppliers that go beyond minimum thresholds—for example by achieving higher reuse or diversion rates—without automatically excluding smaller firms, while mandatory gates ensure that unacceptable practices are filtered out.

Finally, the literature on Green MICE and green public procurement points to an important role for governments and destination authorities. Public bodies can incorporate LCA-informed criteria into venue licensing, grant schemes, and public-sector event tenders; require minimum modularity and formal take-back provisions in exhibitor manuals; offer fiscal incentives such as tax rebates or deposit–refund systems for certified modular assets; and standardise reporting templates to improve data comparability across events (ASEAN Secretariat, 2021; Wee et al., 2021). Clarifying how responsibilities for waste and reporting are shared among organizers, venues, contractors, and exhibitors supported by inspection and disclosure requirements—addresses one of the key weaknesses identified in the literature.

Collectively, this conceptual policy model answers the third research question by demonstrating how LCA findings, stakeholder considerations, and existing policy frameworks can be integrated into a coherent set of procurement instruments tailored to large-scale trade shows. It provides a logically derived framework that can guide organizers, regulators, and suppliers in moving from high-level "green event" commitments toward more concrete, enforceable procurement practices. The next section builds on this synthesis to articulate the study's conclusions and implications for policy, practice, and future research.

4. Conclusion and Implications

4.1 Summary of Key Findings

This study set out to develop a green procurement policy model based on Life Cycle Assessment (LCA) for construction waste mitigation in large-scale trade shows, using a literature-based research design. The synthesis of existing LCA studies, technical reports, and event-sustainability guidance consistently indicates that modular or system booths outperform one-off custom booths in terms of embodied greenhouse gas emissions and construction and demolition (C&D) waste per standard 3 × 3 m booth. Environmental "hotspots" are concentrated in material production (especially MDF/plywood, carpets, and PVC graphics) and end-of-life treatment, while on-site energy and short-haul transport play secondary roles. The main drivers of improvement in modular systems are higher reuse cycles, reduced offcuts and scrap, and the use of formal take-back and recovery schemes.

The literature-based policy and stakeholder analysis further reveals that, despite growing recognition of Green MICE principles, many procurement practices in the exhibition sector remain anchored in unit price and speed, with limited integration of life-cycle performance or verifiable environmental criteria. Barriers include cost and time pressures, lack of storage and ownership clarity for reusable assets, limited access to capable suppliers, and ambiguity regarding responsibility for waste outcomes among organizers, venues, contractors, and exhibitors. At the same time, standards and guidelines such as ISO 20400, ISO 20121, ASEAN GPP, and destination-level sustainable event manuals provide useful principles but do not yet offer detailed, sector-specific enforcement tools for temporary exhibition infrastructure.

By bringing these strands together, the study develops a conceptual green procurement policy model that links LCA-derived insights to procurement decision instruments. The model combines mandatory gates (e.g., minimum modularity and take-back requirements), weighted criteria within a multi-criteria decision analysis (MCDA) framework, and clear documentation and verification requirements. It also highlights the enabling role of public authorities and destination managers in embedding such instruments in licensing, grants, and public procurement. In doing so, the study responds directly to the three research questions: identifying construction waste hotspots, articulating stakeholder and governance constraints, and proposing a coherent policy model that is technically grounded and institutionally aware.

4.2 Theoretical Contribution

Theoretically, the study contributes to the intersection of LCA, public policy, and event management in three main ways. First, it demonstrates how LCA—traditionally applied as a technical tool in product and building assessment—can be repositioned as a decision-support engine within a broader governance framework. Rather than ending at environmental impact results, the literature-based LCA synthesis is explicitly translated into procurement levers (criteria, thresholds, and documentation requirements), showing a structured pathway from environmental analysis to institutional design.

Second, the study sits at the interface between generic sustainable procurement frameworks (e.g., ISO 20400) and the domain-specific realities of Green MICE. By systematically comparing LCA

hotspots with the content of existing standards and guidelines, the research highlights where current frameworks align with the needs of the exhibition sector and where they fall short—particularly in relation to modularity, reuse, and explicit waste-responsibility allocation. This helps bridge a common gap in the literature, where Green MICE is often discussed in qualitative terms, while procurement and LCA are treated in more technical or abstract ways.

Third, the study illustrates a methodological approach for integrating engineering-based evidence with social-science perspectives. The two-phase design—combining literature-based LCA with qualitative policy analysis—offers a template for other researchers seeking to design policy models in sectors where primary data are costly or fragmented, but where a substantial body of case studies, standards, and guidelines already exists. This strengthens the conceptual foundation for future empirical and modelling work on sustainable events and temporary built environments.

4.3 Practical Implications

From a practical standpoint, the study offers several implications for organizers, venues, suppliers, and policy-makers. For event organizers and venues, the findings can be translated into a Green Procurement Checklist that guides the entire procurement cycle for exhibition construction. Key elements include: selecting modular/system booth solutions as the default; specifying minimum reuse cycles and take-back obligations; requiring evidence such as bills of materials, Environmental Product Declarations, and waste weigh-tickets; and setting explicit diversion targets for C&D waste. Integrating these items into tender documents, exhibitor manuals, and post-event reporting can move practice from broad sustainability rhetoric toward verifiable outcomes.

For procurement officers and contract managers, the proposed policy model clarifies how to operationalise sustainability within existing processes. Mandatory gates based on LCA hotspots (e.g., restricting certain materials without recovery routes, requiring disassembly plans) can be established as non-negotiable conditions of participation, while MCDA-based evaluation allows a balanced assessment of environmental performance, execution capacity, and life-cycle cost. This is consistent with the shift advocated in sustainable procurement standards from lowest-price awards to value-based decisions that internalize environmental criteria.

For governments and destination authorities, the study outlines a roadmap from voluntary green claims to more enforceable frameworks. Authorities can embed modularity and take-back requirements in licensing conditions for large events; link compliance with LCA-informed criteria to access to public grants or subsidies; offer fiscal incentives for certified modular assets; and standardize reporting formats to facilitate benchmarking across events and venues. At the same time, clearer contractual clauses and guidance can help delineate waste-related responsibilities among organizers, venues, contractors, and exhibitors, addressing one of the consistent weaknesses identified in the literature.

4.4 Recommendations for Future Research

Given its literature-based design, the study's conclusions are necessarily conceptual and indicative rather than empirically tested. Future research should therefore pursue several complementary directions. First, there is a need for full, site-specific LCAs of custom and modular exhibition systems in different regional contexts, using primary inventory data and robust scenario modelling. Such studies would allow validation and refinement of the relative patterns observed in the literature and could quantify context-dependent variables such as transport distances, local waste infrastructure, and design practices.

Second, future work should conduct economic and financial assessments of the proposed policy model, including cost–benefit or cost-effectiveness analyses that compare increased upfront

investment in modular systems and take-back schemes with avoided material, disposal, and environmental costs over multiple event cycles. This would provide decision-makers with a clearer business case for adopting LCA-informed procurement, and help design fair cost- and risk-sharing arrangements between organizers, venues, and suppliers.

Third, there is scope for pilot implementation and evaluation of the conceptual policy model in real-world trade shows. Action research or longitudinal case studies could test the feasibility of mandatory gates, MCDA-based scoring, and verification requirements in practice, tracking both environmental and organizational outcomes. Such pilots could also explore behavioural responses from exhibitors and contractors, and identify practical refinements to documentation and processes.

Finally, future research could deepen the connection between green procurement for trade shows and broader circular economy strategies. This includes exploring product–service system models (e.g., booth infrastructure as a service), regional sharing platforms for modular components, design-for-disassembly standards, and industrial symbiosis opportunities for secondary materials. By linking event-specific interventions to wider material flows and policy frameworks, scholars and practitioners can better understand how green procurement in the MICE sector contributes to systemic transitions towards low-carbon, circular urban economies

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