Sustainable by Design

AD6502 ENVIRONMENT & SUSTAINABILITY

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1. Introduction

As environmental concerns grow, sustainable interior design is becoming increasingly vital. This report explores the principles, challenges, and strategies involved in designing temporary interiors that minimise environmental impact while enhancing user well-being, adaptability, and longevity. Temporary interiors, often used in settings like pop-up retail, exhibitions, and event spaces, present unique opportunities to integrate sustainability due to their short-term nature and flexibility. The focus of this report will be on material selection, waste reduction, and the role of the circular economy in ensuring that these spaces contribute to a more sustainable built environment.

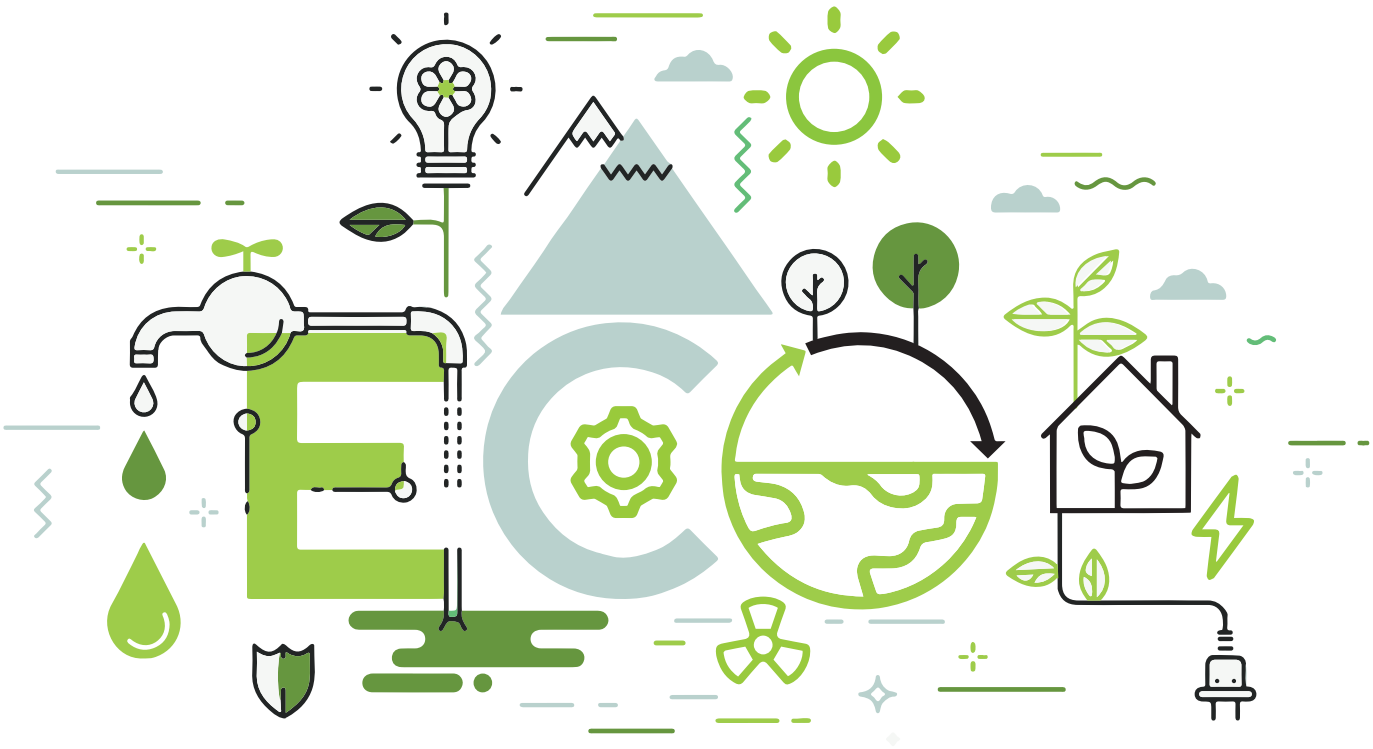


Figure 1. ECO Illustration. Edited. (Information sourced from Ok Credit, 2021).

2. Context

Environmental challenges like resource depletion, pollution, and waste accumulation make sustainable practices essential, especially in construction and interior design's material demands. The waste generated by temporary designs and disposable products puts the environment under strain, with many materials ultimately ending up in landfills.

2. The Environment

Sustainability must be a at the center of every design. The question is how to address it, from innovative everyday objects to large-scale urban projects. This is a pivotal moment for design professionals to choose between indulgent consumption and a more thoughtful approach that prioritises the natural world. Issues such as climate change, resource depletion, biodiversity loss, waste, and well-being are all increased by the challenges of population growth.

2.1 Climate Change

Climate change is primarily driven by carbon emissions and energy consumption. Key contributors to climate change include burning fossil fuels for energy and transportation, deforestation, and landfills emitting greenhouse gases like carbon dioxide and methane. These activities increase the natural greenhouse effect, trapping more radiation and overheating the planet.

2.2 Construction

Buildings and construction have a significant environmental footprint, accounting for nearly 40% of global energy use and 30% of greenhouse gas emissions, according to the International Energy Agency (IEA). This includes operational energy for building use and embodied energy from material extraction, processing, and manufacturing.

In the UK, construction materials transport represents 30% of road freight and 10% of carbon emissions. The construction sector is responsible for 20% of material use, 25% of global timber harvest, and 20% of UK waste, often due to over-ordering and inefficient resource recovery. The World Green Building Council (WGBC) highlights the energy demands of construction, building operations, and interior design, calling for innovative approaches to reduce the sector's environmental impact.

2.3 Diminishing Resources and Biodiversity

Resource depletion caused by the excessive use of non-renewable materials outs a great amount of pressure on ecosystems. Natural resources like forests, fossil fuels, and minerals are being used faster than they can regenerate. Some materials, such as fossil fuels, are finite and cannot be replenished. And their scarcity drives up their economic value as reserves run out.

Additionally, deforestation and habitat destruction are leaving many species vulnerable or even extinct. This loss of biodiversity disrupts ecosystems, causing imbalances that can have a damaging consequences for both wildlife and humanity.

2.4 Waste

Overconsumption is driving environmental degradation and releasing harmful pollutants into the soil, air, and atmosphere. As our consumption habits grow, so does the need for more space to store our purchases and the waste they generate. Many production methods are highly inefficient, contributing to a throwaway culture that fills up landfill sites.

2.5 Water Scarcity

Water consumption is rising well beyond essential needs. Construction alone consumes one-sixth of the world's clean water, making this a pressing issue at regional, national, and global levels. Water is not only essential for daily life but also for manufacturing and energy production. For example, producing a single pair of jeans can require 7,250 litres of water (Sustainability Magazine, 2021.) Revealing the hidden environmental cost of everyday items. Additionally, water-intensive manufacturing processes deplete valuable freshwater resources and contribute to pollution through untreated wastewater.

2.6 Pollution Growth

With people living longer and the global population continuing to grow, the strain on the environment is getting worse. More humans activity increases the environmental impacts already discussed, such as resource depletion, pollution, and habitat destruction. This rising demand for energy, water, and materials puts ecosystems under pressure.

2.7 Wellbeing

Poor indoor air quality, often caused by volatile organic compounds (VOCs) emitted from paints, finishes, adhesives, and furnishings, contributes to pollution and health risks. These substances release harmful gases that can lead to allergies, headaches, fatigue, and other health issues. Spending so much time indoors exposes individuals to these toxins, creating an unhealthy living environment. This toxic indoor environment significantly impacts mental health and overall well-being.

2.8 Social Pressure

As societal pressures rise, fueled by social media's influence, there's an increasing desire to appear aesthetically pleasing and showing idealized lifestyles through beautiful homes, travel, and curated experiences. These social pressures often drive aspirations for better living spaces, but the amount of choices and competitive markets can overwhelm consumers. To attract customers, some businesses cut corners in manufacturing to lower prices, often at the expense of quality.

3. Interior Design

Interior designers can play a critical role in promoting sustainability through more thoughtful refurbishments, fit-outs, and spatial strategies. By considering environmental factors in their design choices, interior designers can help create spaces that are both functional and eco-conscious, supporting a more sustainable future.

3. Interior Spaces

Interior spaces are always evolving, shaped by changing owners, functions, and personal needs. Unlike architecture, which is more permanent, interiors tend to follow trends and individual tastes, often giving them shorter lifespans depending on their purpose.

John Ruskin spoke about the moral responsibility to protect the Earth, while William Morris emphasised valuing materials. Gottfried Semper, with his ideas on architecture, function, and materiality, also influence sustainable design. These ideas are being embraced as the design world moves toward a more sustainable future.

3.1 Principles

Circular economy principles, focuses on modularity, waste reduction, disassembly, reuse, and recycling. By selecting responsible materials, such as low-VOC products, designers can reduce both environmental and health impacts.

Integrating features like natural lighting and water-saving fixtures also helps minimize energy and water consumption. Publications like Archis highlight the environmental concerns associated with shorter interior lifespans, discuss the need for durable, eco-friendly solutions.

3.2 Strategies

Around the world, interior designers, architects, and innovators are embracing strategies like industrial symbiosis, biomimicry (such as the Buga Pavilion in Germany, designed with acoustics in mind, demonstrating the idea that function determines form, and following the strategies outlined in Figure 3), and circular economies to tackle environmental challenges. These approaches aren't just about conserving resources—they're about rethinking design in the built environment.

3.3 Challenges

While progress in sustainable design and construction has been made, evaluating the true sustainability of projects remains a challenge—especially with the rise of green-washing. Designers are now being trained to prioritise meaningful, innovative solutions over superficial aesthetics.

William Morris - Strawberry Thief

Figure 2. William Morris Strawberry Thief Print. (Pixels, 2020)

"Morris's love for nature deeply influenced his work, with natural motifs like the famed "Strawberry Thief" print becoming a hallmark of his design. His use of natural dyes and traditional manufacturing techniques also reflected an early form of environmentalism. Morris's work encourages a sustainable approach to design, valuing materials and methods that minimize harm to the environment."

(The Trumpet Shop, 2024)

- Use of Reclaimed Materials

  Incorporating inventory materials from previous designs, sourcing locally, and maximising the use of materials' properties and dimensions.

- Regenerative Materials

  Evaluating bio-based materials impact during production, their transportation efficiency and their alignment with conservation practices and selecting materials correctly, that are fit for purpose.

- Design for Disassembly

  Materials can be connected without adhesives, using interlocking or mechanical systems that allow for easy disassembly.

- Flexible and Adaptability

  Designing for flexibility and adaptability and using standardised sizes, helps in simplifying production.
  Keeping data about products enables better tracking, maintenance, and future re-purposing.

- Design for Longevity

  Using flexible, durable designs that are easy to maintain and repair.

- Ownership

  To prevent the single-use cycle of materials and products, exploring options such as rentals, borrowing, or take-back programs can significantly reduce waste.

Figure 3. Strategies. (Information sourced from Van den Heuvel, 2023).

4. Longevity in Interior Design

This chapter examines longevity in design, exploring the balance between long-term durability and short-term adaptability and the factors influencing these choices in sustainable interiors.

4. Longevity

In interior design, longevity focuses on creating spaces and selecting materials that endure over time, reducing the need for frequent replacements. Historically, buildings were designed for durability, using locally sourced materials and practical solutions tailored to their environment. Materials were chosen not only for their longevity but also for their functionality. Existing buildings contribute to sustainability by reducing the need for new construction and preserving valuable resources.

4.1 Designing for Short-Term Interiors

Short-term or temporary interiors prioritise flexibility and adaptability, designed so they are easily assembled and disassembled for their limited lifespans. These spaces or temporary set-ups are for specific needs. Minimising disruption and waste. Examples include pop-up spaces, event venues, stores, or offices in fast-evolving industries.

4.2 Determining the Best Approach

The choice between longevity-driven and temporary interiors depends on the specific context and goals of the space. Longevity-driven interiors are more appropriate for spaces requiring stability and minimal maintenance, such as residential homes or long-term office environments. However temporary interiors allow for quick modifications in response to evolving needs, trends and user requirements or spaces that experience frequent changes.

The key lies in balancing both approaches—integrating flexible, adaptable elements into permanent structures, allowing spaces to evolve while maintaining long-term stability. Both approaches offer value depending on the design objectives and context.

4.3 Shearing Layers Model

The Shearing Layers model effectively balances short-term adaptability with long-term longevity by separating the different elements of a building. (See figure 4).

The outer layers, such as the "Skin" and "Structure," are designed for durability and stability, to withstand environmental conditions and provide resilience. In contrast, the inner layers—" Space Plan" and "Stuff"—are designed to be flexible and easily changeable. These layers, including lighting, partitions, furniture, and finishes, can be updated, or replaced as needed without affecting the building's overall structure. This model fosters a sustainable and balanced approach to architecture and interior design.

Google Office

Figure 4. Google Office (Dezeen, 2018)

The adaptive reuse of the Spruce Goose Hangar by ZGF Architects in Los Angeles integrates a modern office into a historic piece of architecture. The design features a "building within a building," with new floor plates thoughtfully incorporated into the large hangar space.

Shearing Layers Model

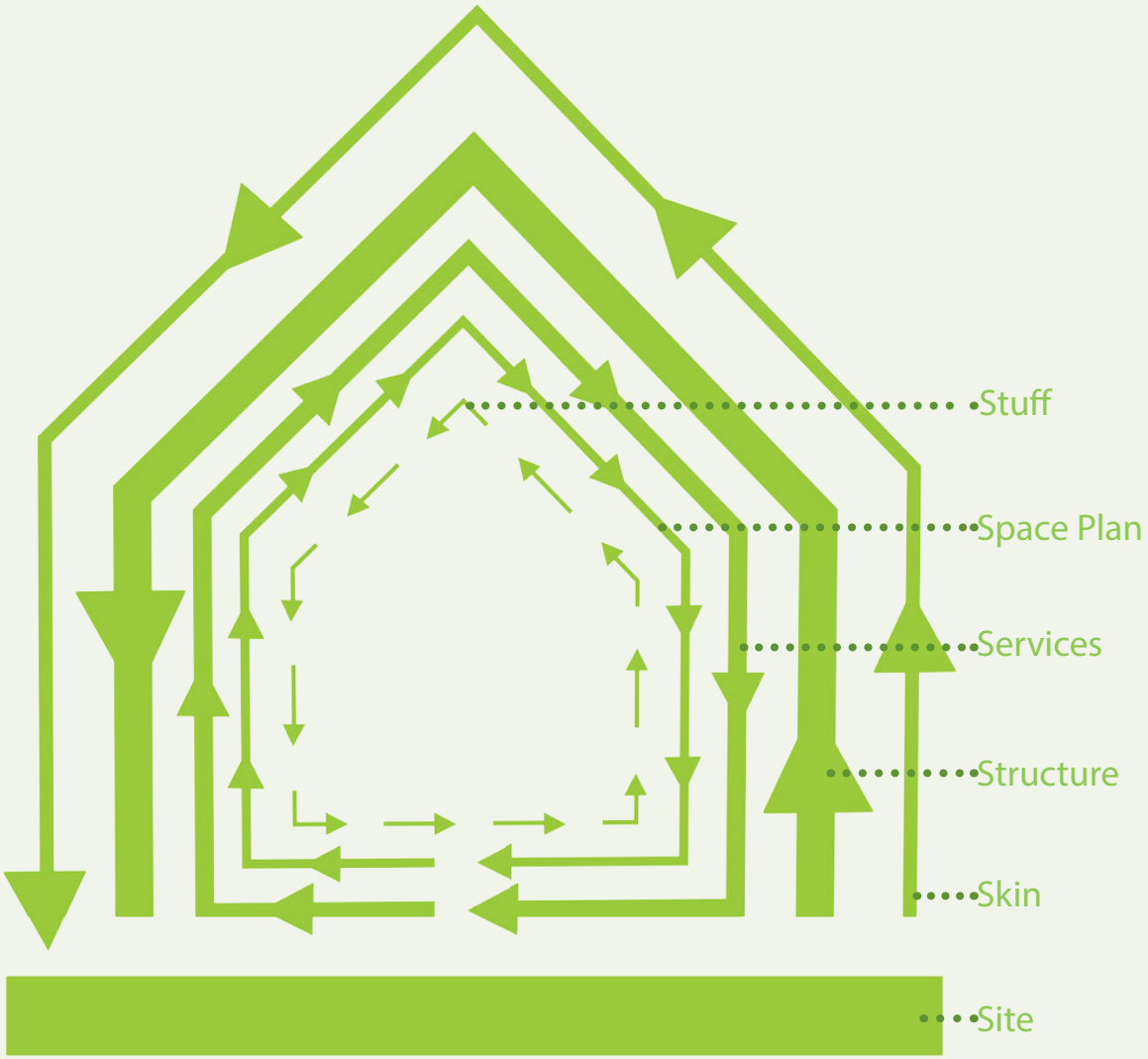


Figure 5 .Shearing Layers. Authors Own. (Information sourced from Van den Heuvel, 2023).

5. Design Considerations for Temporary

Temporary spaces must address short-term functionality while minimising environmental impact. This demands a careful balance between material choices, construction methods, and energy efficiency, all guided by principles of sustainability. Below, key considerations are explored to illustrate how interior design can achieve sustainability.

5.1 Purpose

What sustainable measures are appropriate? Fully understanding the client's needs is essential, as every purpose comes with specific requirements. This includes conducting thorough site analysis, research, and clear briefing. Key considerations include acoustics, fire safety, accessibility, and maintenance. It's also important to account for the demographics using the space, ensuring factors like lighting controls, heights, and other features are tailored appropriately. Materials must be fit for purpose, durable, and able to withstand wear and tear.

5.2 Time

Understanding how long an interior will be in use allows designers to plan effectively, whether it's temporary, long-term, or flexible. Each requires a unique design approach to ensure a successful project. No project is truly permanent; it is simply classified as long-term. This highlights the importance of investing in the correct materials and incorporating efficient energy and water usage into the design.

5.3 Energy & Water Systems

Site analysis is key to identifying efficient energy and waste solutions sustainable such as integrating passive design strategies (see figure 5). Optimising natural light in frequently used spaces and placing less-used areas in darker zones helps reduce energy use. Features like timers, motion sensors, and separate lighting circuits further enhance efficiency. Accessible heating and ventilation systems ensure easy operation, while designing to encourage eco-friendly behaviors, such as incorporating recycling areas, supports effective waste management. Portable renewable energy solutions, like solar panels, are a practical without requiring permanent infrastructure.

Corte Bertesina

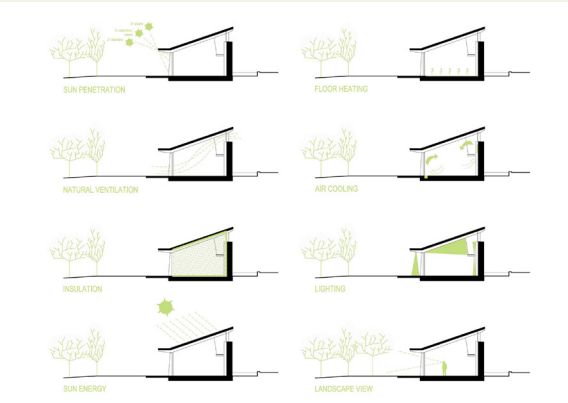


Figure 6. Passive Design. Edited. (Information sourced from traverso-vighy, 2017).

Passive design is an approach that maximizes the energy efficiency of a building by leveraging its design features. Working in harmony with the natural environment, rather than against it. Key strategies in passive design include:

- Thermal insulation
- Solar gain and solar control
- Air tightness
- Natural ventilation
- Thermal mass
- Natural day lighting

y Interiors

Designing sustainable interiors for short-term use requires thoughtful planning, careful material selection, and adaptable construction methods. By embracing concepts like the Circular Economy, Cradle to Cradle, and life cycle planning, temporary projects can reduce their environmental footprint without compromising functionality. Through efficient resource use and sustainable strategies, interior designers can create spaces that align with the growing need for environmental responsibility.

5.4 Materials & Finishes

The choice of materials is vital to achieving sustainable interiors, whether temporary or long-term. Designers must balance characteristics like durability, flexibility, weight, texture, color and reflectance, with sustainability factors such as embodied energy, VOC emissions, renewability, and recycled content. Sourcing materials locally supports sustainability by reducing transportation emissions and strengthening community ties. Thoughtful use of reflective, light-colored materials in darker spaces can enhance natural light, reducing the need for artificial lighting. New material technologies, renewable resources, bio-based materials, and advancements in recycled products to meet the growing demand for eco-friendly interiors.

5.5 Construction Methods

The choice and appropriate approach to a construction method depends on the purpose of the project and its specific requirements. Some elements may need to be dismantled easily or hidden for safety, requiring more solid and robust fixing. For temporary interiors, construction methods must be efficient, cost-effective, and environmentally responsible. Dry construction techniques, such as modular or prefabricated systems, allow for easy assembly and disassembly.

5.6 Function

Understanding how occupants will use a space is essential. Modular furniture, movable partitions, and multipurpose elements allow spaces to evolve with their users' needs, reducing material waste and extending the life cycle of interior components. Modular systems can enhance flexibility and reduce resource consumption. Projects like Sky House, with adaptable rooms designed for limited space in Japan, showcase how flexible design elements can enhance both functionality and sustainability in environments where space is at a premium.

For temporary interiors, lightweight and recyclable or biodegradable materials, such as bamboo, reclaimed wood, or recycled plastics, are ideal. These materials minimise environmental impact and waste while offering durability and adaptability. Using natural finishes eliminates the need for additional treatments, streamlining the life cycle of the materials.

Bamboo

Figure 7. Bamboo (Positively Sustainable, 2020)

5. Design Considerations for Temporary Interiors

5.7 The Circular Economy

The Circular Economy, supported by frameworks like Ellen MacArthur's Circular Economy System, the 10R Model, and Cradle to Cradle, focuses on minimising waste and maximising resource efficiency by rethinking design, extending material life cycles, and ensuring products can be reused, recycled, or safely returned to nature. Life cycle and End-of-Life Planning ensure these principles are applied throughout a product's entire journey, from creation to disposal.

By moving away from the traditional linear "take-make-dispose" model, the circular economy aims to keep materials in circulation through reuse, refurbishment, and recycling. For temporary interiors, this approach reduces waste and enhances resource efficiency by using modular, reusable elements and materials that are easy to disassemble and repurpose.

5.8 Ellen MacArthur's Circular Economy

Figure 7 shows this model's concept of Biological and Technical Cycles. It distinguishes between biological materials, which can safely return to the environment, and technical materials, which should be continually reused without losing value. This concept encourages the separation of materials into these two categories to ease the process of recycling and reuse, ensuring that each type of material is handled in the most sustainable way.

This framework emphasizes the importance of preserving the value of non-biodegradable materials, like metals, keeping them in circulation for as long as possible. If reuse isn't possible, recycling becomes the next best option, as it retains the material's value, even if the product itself no longer maintains its original form. To align with this approach, designs should incorporate components that are easy to disassemble rather than fused together, making it simpler to separate and recycle materials. The goal is to maximise the utility and value of resources by maintaining their integrity and usability over time.

Circular Economy Systems Diagram

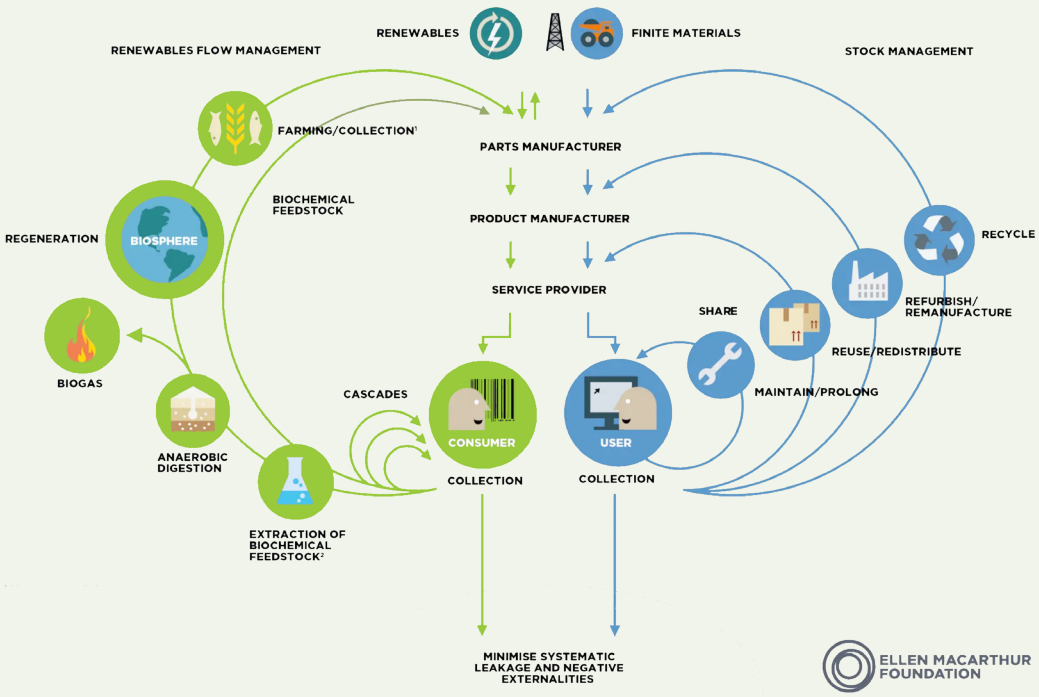


Figure 8. Circular Economy Systems Diagram (Ellen MacArthur Foundation, 2019)

5.9 Cradle to Cradle (C2C)

The Cradle to Cradle (C2C) framework focuses on the complete elimination of waste. This approach ensures materials either return safely to the earth or are continually reused within a closed-loop system. Designers are encouraged to use pre-certified materials, biodegradable finishes, and recyclable components that align with C2C principles. By adopting this approach, temporary interiors can incorporate clear end-of-life strategies, ensuring that materials remain part of a sustainable cycle and contribute to a long-lasting environmental benefit.

5.10 The 10R Model

The 10R Model expands on the traditional "Reduce, Reuse, Recycle" framework, incorporating additional strategies such as remanufacturing, re purposing, and rethinking design choices. These approaches allow designers to create adaptable, resource-efficient interiors while minimising their environmental footprint. For instance, modular systems can be dismantled and reused in future projects, embodying the 10R principles and contributing to a more circular life cycle (see figure 8).

5.11 Life cycle & End-of-Life Planning

Life cycle and end-of-life planning integrate the principles of circular economy, the 10R Model, and Cradle to Cradle by emphasising the entire journey of materials. Tools like life cycle assessments (LCA) and material passports can help identify materials that are suitable for reuse or recycling, ensuring they remain part of the circular economy. By considering the end-of-life stage during the design process, designers can minimise waste and maximise the re purposing of materials, ensuring temporary interiors contribute to sustainability without causing long-term environmental harm.

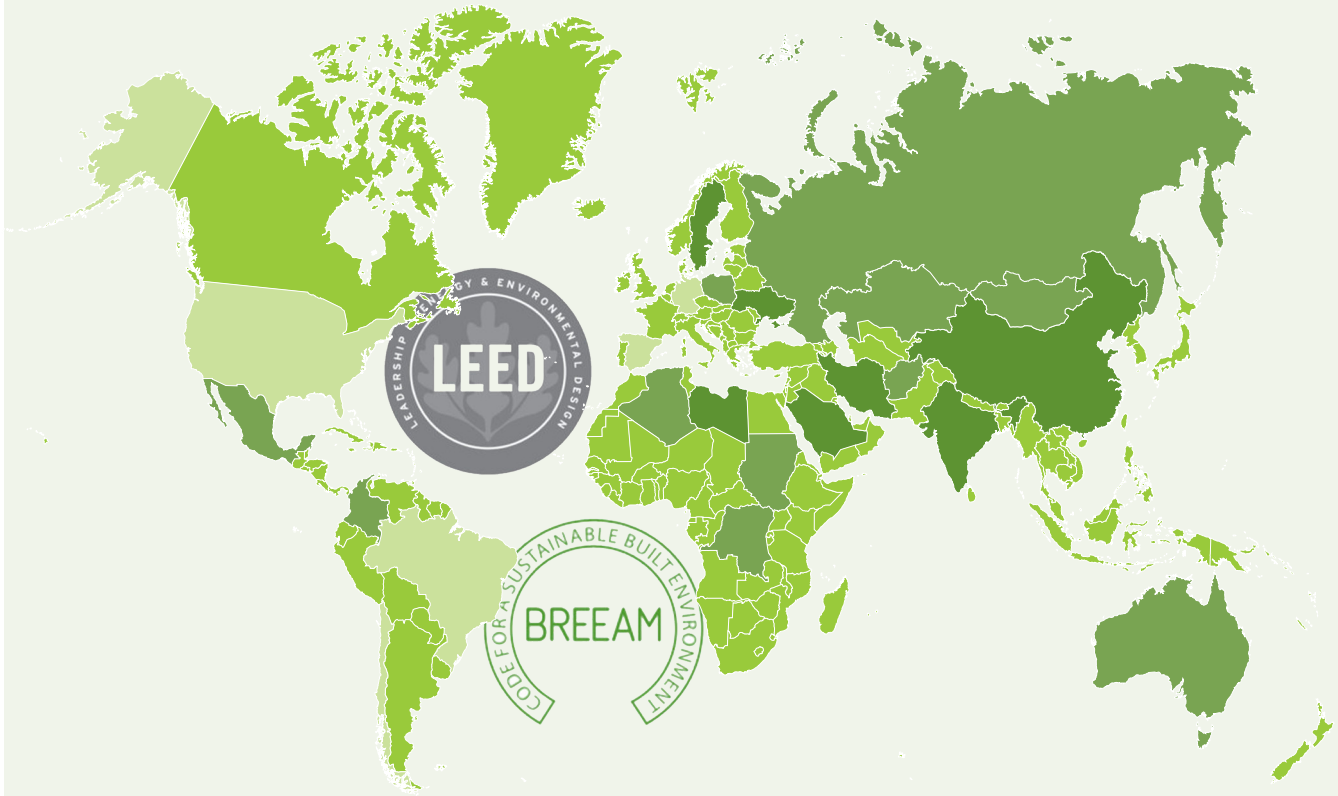
5.12 Technology

Technology is playing a key role in shaping the future of interior design, particularly within the circular economy. Tools such as Madaster use digital material passports that track materials used in construction and interiors. These passports allow designers to monitor material life cycles, promote reuse and recycling, and reduce waste, ensuring resources remain in circulation while improving transparency in resource management.

Artificial intelligence (AI) is another use of technology offering solutions for material choices by analysing data. These tools can balance aesthetics, functionality, and sustainability, while also suggesting spatial strategies for space efficiency and optimising energy efficiency by adjusting lighting, heating, and ventilation systems in real time.

Figure 9. The 10R Model. Authors Own. (Information sourced from Van den Heuvel, 2023).

Global Map



LEED 80,000 projects across 162 countries.
BREEAM Over 15 000 projects over 50 countries.

Figure 10. Global Map. Edited. (Information sourced from WINT, 2024)

5.13 The UN & Global Sustainable Frameworks

The United Nations' 17 Sustainable Development Goals (SDGs) set the framework for global sustainability challenges and objectives, guiding governments and organizations in promoting a greener and better future. These goals are reviewed and discussed at global conferences, encouraging international collaboration and policy changes. Governments also implement formal assessment schemes to ensure their practices align with these global objectives.

In the UK, one of the most significant steps towards green design has been the development of BREEAM (Building Research Establishment Environmental Assessment Method), which was introduced in 1990. Along with similar systems like LEED (Leadership in Energy and Environmental Design) in the US, BREEAM provides guidelines and check-lists to assess the environmental performance of buildings. While these systems set clear sustainability goals, they can be expensive and require trade-offs, where improvements in one area might mean adjustments in another.

The World Green Building Council plays a key role in bringing national green building councils together, encouraging cross-border collaboration. While sustainability challenges are global, solutions often need to be adapted to local climates and conditions. That's why localized councils are important in addressing the unique challenges of different regions.

5.14 Overshoot Day

Overshoot day is a reminder of the urgent need to tackle sustainability. It marks the day each year when resource consumption exceeds the planet's ability to regenerate. The goal is to push this date later in the year by adopting sustainable practices across design, construction, and everyday life, ensuring future generations inherit a planet that can sustain their needs.

6. Conclusions & Recommendations

Sustainability in interior design is no longer a choice but a necessity in the face of global challenges such as climate change, resource depletion, and social pressures. As explored in this report, the built environment has a significant role to play in addressing these issues by adopting strategies that balance functionality, well-being, and environmental responsibility.

From understanding the impact of diminishing resources, water scarcity, and pollution growth to recognising the social and psychological importance of well-designed spaces, it is clear that interior design must evolve to meet these demands. Embracing principles of longevity, adaptability, and the circular economy provides a clear pathway toward more sustainable practices. Frameworks like Ellen MacArthur's Circular Economy, the Cradle to Cradle approach, and the 10R Model offer valuable guidance, while technologies such as AI and material passports enable more efficient resource management and design solutions.

Designing for temporary interiors presents unique challenges and opportunities. By prioritising renewable materials, energy-efficient systems, and life cycle planning, designers can ensure spaces that are not only functional but also environmentally conscious. The inclusion of concepts like the Shearing Layers Model and collaboration between architects, engineers, and policymakers further ensures that sustainability goals are met without compromising aesthetics or performance.

Ultimately, sustainable interior design demands a forward-thinking, holistic approach that considers every stage of a space's life cycle. By integrating innovation with responsibility, interior design can support the global push for sustainability, creating environments that are enriching, adaptable, and capable of meeting the needs of both present and future generations.

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AD6502 Environment & Sustainability

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