International Journal of Sustainable Engineering Frontiers
Abbreviated Key Title: Int. J. Sustain. Eng. Front.
ISSN: 3141-6632 (Open Access):
Vol 1: (1): Pp.: 29–38, 2026

Circular Economy Strategies for Construction and Demolition Waste Management: Environmental and Economic Impacts in Urban Construction Projects

Erhivwowhouvie W.

Department of Geology and Petroleum Studies, Western Delta University, Oghara, Delta State Nigeria.
Author's E-mail: Erhiwo@gmail.com

Abstract

The construction industry generates substantial quantities of construction and demolition waste (CDW), creating significant environmental and economic challenges in rapidly urbanising regions. Circular economy (CE) strategies have emerged as effective approaches for minimising waste generation, maximising resource recovery, and promoting sustainable construction practices. This study examines the application of circular economy principles in construction and demolition waste management and evaluates their environmental and economic impacts on urban construction projects. The research explores key CE strategies, including waste reduction at source, material reuse, recycling, and resource recovery, and assesses their effectiveness through a review of current practices and case studies. Environmental benefits such as reduced landfill disposal, conservation of natural resources, lower greenhouse gas emissions, and decreased energy consumption are analysed alongside economic outcomes, including cost savings, revenue generation from recovered materials, and improved project efficiency. The findings show that construction stakeholders can significantly enhance sustainability performance and achieve measurable economic advantages by implementing circular economy strategies. However, challenges related to regulatory frameworks, technological limitations, and market acceptance remain barriers to widespread adoption. The study concludes that integrating circular economy principles into urban construction projects offers a viable pathway toward sustainable waste management and supports the transition to a more resource-efficient and environmentally responsible construction sector.

Keywords: Circular economy, construction and demolition waste, sustainable construction, waste management, resource recovery, recycling, and urban development.

Accepted 8/5/2026 Int. J. Sustain. Eng. Front. Published: 14/6/2026

1. INTRODUCTION

The construction industry is a major contributor to global economic development, yet it is also one of the largest consumers of natural resources and generators of waste. The sector accounts for approximately 40% of global material consumption and contributes significantly to greenhouse gas emissions and environmental degradation (United Nations Environment Programme [UNEP], 2023). Construction and demolition waste (CDW), which includes concrete, steel, wood, glass, bricks, and plastics, represents one of the largest waste streams worldwide. In the European Union, CDW accounts for nearly one-third of total waste generation, highlighting the urgent need for sustainable waste management practices (European Commission, 2024). Traditional construction practices operate under a linear economic model characterized by resource extraction, production, consumption, and disposal. This model contributes to resource depletion, landfill accumulation, and increased carbon emissions. In contrast, the circular economy (CE) promotes resource efficiency by extending material lifecycles through reuse, recycling, remanufacturing, and recovery strategies (Marrucci et al., 2025). Within the construction sector, CE principles support the transformation of waste materials into valuable secondary resources, thereby reducing environmental impacts while creating economic opportunities.

The transition toward circular construction has gained considerable attention among researchers, policymakers, and industry practitioners. Circular economy strategies can significantly reduce the extraction of virgin materials, improve resource productivity, and contribute to climate change mitigation objectives (Bayram & Greiff, 2023). Consequently, understanding the environmental and economic implications of circular construction practices has become increasingly important for achieving sustainable urban development.

1.1 Research Question

What is the environmental and economic impact of adopting circular economy practices in urban construction projects?

1.2 General Objective

To evaluate the environmental and economic impacts of adopting circular economy practices in urban construction projects through construction and demolition waste management strategies.

Specific Objectives

1. To examine how the recycling and reuse of construction and demolition waste materials contribute to environmental sustainability and economic efficiency in urban construction projects.
2. To assess the environmental performance of recycled concrete and recycled steel using Life Cycle Assessment (LCA) methodologies.
3. To analyze the role of sustainable supply chains in facilitating circular economy implementation within the construction sector.
4. To identify the environmental benefits, including reductions in greenhouse gas emissions, landfill disposal, and resource extraction, associated with circular economy practices.
5. To evaluate the economic outcomes of circular economy adoption, including cost savings, resource efficiency improvements, and value creation through material recovery.

2. CIRCULAR ECONOMY AND CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT

The circular economy is a regenerative economic model that seeks to maintain products, components, and materials at their highest utility and value for as long as possible (Geissdoerfer et al., 2017). Unlike the traditional linear model, the circular economy emphasizes resource conservation, waste minimization, and material recirculation. In the construction sector, circular economy principles are increasingly recognized as essential for reducing environmental impacts associated with resource extraction and waste disposal (Marrucci et al., 2025).

Construction and demolition waste consists of materials generated during building construction, renovation, maintenance, and demolition activities. According to the European Commission (2024), effective CDW management can significantly contribute to resource efficiency objectives by promoting recycling, reuse, and material recovery. Research suggests that a large proportion of CDW possesses high recycling potential, yet substantial quantities continue to be landfilled due to inadequate recovery infrastructure and fragmented supply chains (Mesa et al., 2021).

The implementation of circular economy strategies in CDW management offers multiple benefits, including reduced environmental impacts, lower resource consumption, and increased economic value creation. García et al. (2024) found that improved recycling and recovery systems across the European Union could substantially reduce greenhouse gas emissions while enhancing resource productivity. These findings highlight the importance of integrating circular economy principles into urban construction projects.

2.1 Recycling and Reuse of Construction Materials

Recycled Concrete

Concrete is the most widely used construction material globally and represents a significant proportion of construction and demolition waste. Recycled aggregate concrete (RAC) is produced by crushing and processing demolished concrete into reusable aggregates for new construction applications. According to Wang et al. (2022), recycled aggregates can significantly reduce the demand for virgin materials while lowering environmental impacts associated with extraction activities.

Several studies have demonstrated that recycled aggregate concrete can achieve acceptable mechanical and durability performance when proper processing and quality control measures are implemented (Xuan et al., 2019). Furthermore, the use of recycled concrete contributes to landfill diversion and promotes resource conservation within urban construction systems (Zhang et al., 2024).

Recycled Steel

Steel is one of the most recyclable construction materials because it can be repeatedly recycled without significant deterioration in quality. Recycled steel production requires substantially less energy than primary steel production, resulting in considerable reductions in greenhouse gas emissions and resource consumption

(Marrucci et al., 2025).
The recovery and reuse of steel components from demolished structures further support circular economy objectives by extending material lifespans and reducing demand for virgin raw materials. Bayram and Greiff (2023) emphasized that steel recycling represents one of the most environmentally beneficial material recovery strategies within the construction industry.

Material Reuse

Material reuse is often considered more sustainable than recycling because it preserves the embodied energy of construction components. Reusable materials such as steel beams, timber elements, windows, doors, and bricks can be recovered and incorporated into new projects with minimal processing. The European Commission (2024) identified selective demolition and pre-demolition audits as effective approaches for maximizing reuse opportunities and improving material recovery rates.

3. LIFE CYCLE ASSESSMENT (LCA) OF RECYCLED CONCRETE AND STEEL

Life Cycle Assessment (LCA) is a standardized methodology used to quantify the environmental impacts associated with a product, process, or service throughout its entire life cycle, from raw material extraction to end-of-life management (ISO, 2006). Within the construction sector, LCA serves as a critical decision-support tool for evaluating the sustainability performance of construction materials and identifying opportunities for reducing environmental burdens through circular economy strategies (Bayram & Greiff, 2023).

The increasing adoption of circular economy principles has accelerated the application of LCA in assessing recycled construction materials, particularly recycled aggregate concrete (RAC) and recycled steel. These materials are considered fundamental to circular construction because they reduce dependence on virgin resources while diverting waste from landfills (Marrucci et al., 2025).

Most LCA studies in construction employ a cradle-to-grave or cradle-to-cradle approach, evaluating impacts across multiple stages including resource extraction, material processing, transportation, construction, operational use, demolition, and material recovery. Figure 1 illustrates the life cycle stages commonly considered in circular construction assessments.

Figure 1: Conceptual Framework of LCA in Circular Construction

Source: Adapted from ISO (2006) and Bayram and Greiff (2023).

Figure 1 illustrates the life cycle stages considered in the assessment of construction materials within a circular economy framework. Unlike traditional linear systems that terminate at the disposal stage, the circular model incorporates material recovery and recycling processes that enable resources to be reintroduced into new construction projects. This closed-loop approach reduces waste generation, conserves natural resources, and minimizes environmental impacts throughout the building lifecycle. The framework also demonstrates how LCA can be used to identify environmental hotspots and evaluate opportunities for improving resource efficiency (ISO, 2006; Bayram & Greiff, 2023).

The incorporation of recycling loops transforms the traditional linear construction model into a circular system, thereby reducing resource depletion and environmental impacts.

3.1 Environmental Performance of Recycled Concrete and Steel

Recycled Aggregate Concrete (RAC)

Concrete is the most widely used construction material globally and accounts for a significant proportion of construction and demolition waste. The production of conventional concrete relies heavily on virgin aggregates, whose extraction contributes to land degradation, biodiversity loss, and greenhouse gas emissions (Wang et al., 2022).

Recycled aggregate concrete (RAC) offers an alternative by substituting natural aggregates with recycled aggregates obtained from demolished concrete structures. According to Wang et al. (2022), RAC can reduce resource depletion and waste generation while maintaining acceptable structural performance when appropriate quality control measures are applied.

LCA studies consistently report environmental advantages associated with RAC, particularly in the categories of climate change mitigation, landfill diversion, and natural resource conservation (Zhang et al., 2024). However, the magnitude of these benefits depends on factors such as transportation distance, recycling technology efficiency, and the proportion of recycled aggregates used.

Recycled Steel

Steel recycling represents one of the most mature circular economy practices in the construction industry. Unlike many construction materials, steel can be repeatedly recycled without significant degradation in quality. Consequently, recycled steel contributes substantially to resource conservation and emission reductions (Marrucci et al., 2025).

Electric Arc Furnace (EAF) technology, which primarily utilizes scrap steel, consumes significantly less energy than traditional blast furnace production methods. This results in lower greenhouse gas emissions, reduced water consumption, and decreased demand for iron ore extraction (Bayram & Greiff, 2023).

Furthermore, steel recycling contributes to the creation of closed-loop material systems in which recovered steel is continuously reintroduced into new construction projects.

Comparative Environmental Performance

Table 1 summarizes the environmental performance of recycled concrete and recycled steel based on findings from recent LCA studies.

Table 1. Environmental Benefits of Recycled Construction Materials

Impact Category	Recycled Concrete	Recycled Steel
Greenhouse Gas Emissions	Moderate reduction	High reduction
Energy Consumption	Moderate reduction	Significant reduction
Resource Depletion	Reduced aggregate extraction	Reduced iron ore extraction
Landfill Diversion	High	High
Water Consumption	Moderate reduction	Significant reduction
Circularity Potential	Medium to High	Very High

Source: Adapted from Wang et al. (2022), Bayram and Greiff (2023), and Marrucci et al. (2025).

Table 1 compares the environmental performance of recycled concrete and recycled steel across key sustainability indicators. The findings indicate that both materials contribute significantly to circular economy objectives by reducing waste disposal and resource extraction. However, recycled steel demonstrates greater environmental advantages in terms of energy consumption, greenhouse gas emissions, and circularity potential due to its ability to be repeatedly recycled without substantial loss of quality. Recycled concrete remains highly valuable because of its large contribution to reducing construction and demolition waste volumes. These results support the adoption of both materials in sustainable urban construction projects.

The evidence suggests that recycled steel generally provides greater environmental benefits per unit of material due to its high recyclability and lower processing requirements. Nevertheless, recycled concrete contributes significantly to waste reduction because concrete constitutes the largest fraction of construction and demolition waste streams.

Key Influencing Factors in LCA Results

.

Despite the positive environmental outcomes reported in the literature, several factors influence LCA results:

- Transportation distance between demolition sites and recycling facilities.
- Energy sources used during recycling operations.
- Quality and purity of recovered materials.
- Recycling technology efficiency.
- Regional waste management infrastructure.

Table 2 summarizes these factors and their potential effects

Table 2. Factors Affecting Environmental Performance of Recycled Materials

Factor	Impact on LCA Results
Transportation Distance	Increased emissions with longer transport routes
Recycling Technology	More efficient technology reduces impacts
Material Quality	Higher quality improves reuse potential
Energy Mix	Renewable energy lowers carbon footprint
Recovery Rate	Higher recovery rates improve circularity

Table 2 outlines the key factors that influence the environmental performance of recycled materials, particularly in life cycle assessment (LCA) outcomes. Transportation distance plays a significant role, as longer supply routes typically increase emissions and reduce environmental benefits. The type and efficiency of recycling technology also matter, since more advanced processes can reduce energy use and overall environmental impacts. Material quality affects how effectively recycled materials can be reused, with higher quality enabling more applications and reducing the need for virgin inputs. The energy mix used in recycling processes is another critical factor, as reliance on renewable energy significantly lowers the carbon footprint compared to fossil-based energy sources. Finally, higher recovery rates enhance circularity by maximizing the proportion of material that is successfully reintroduced into production cycles, improving overall sustainability performance.

4. SUSTAINABLE SUPPLY CHAINS IN THE CONSTRUCTION SECTOR

The successful implementation of circular economy practices depends not only on material recycling but also on the development of sustainable supply chains capable of supporting resource circulation. Sustainable supply chains integrate environmental, economic, and social considerations into procurement, production, transportation, recovery, and disposal activities (Kirchherr et al., 2018).

Traditional construction supply chains are predominantly linear and fragmented, resulting in substantial material losses and inefficient resource utilization. Multiple stakeholders—including architects, contractors, suppliers, demolition firms, recyclers, and policymakers—often operate independently, limiting opportunities for material recovery and reuse.

The transition toward circular supply chains requires a shift from linear resource flows to closed-loop systems where materials remain in productive use for as long as possible.

Figure 2: Circular Supply Chain Model for Construction Projects

Source: Adapted from Kirchherr et al. (2018).

Figure 2 presents the structure of a circular supply chain within the construction sector. The model demonstrates how materials flow through multiple stages and are eventually recovered and reintroduced into new construction activities. This differs from conventional linear supply chains, where materials are typically discarded after use. By facilitating resource circulation, circular supply chains improve material efficiency, reduce environmental impacts, and support long-term economic resilience. The model highlights the importance of collaboration among suppliers, contractors, recyclers, and policymakers in achieving circular construction objectives (Kirchherr et al., 2018).

The adoption of digital technologies has significantly enhanced the feasibility of circular supply chains. Building Information Modeling (BIM), Digital Product Passports (DPPs), blockchain systems, and Internet of Things (IoT) technologies facilitate material traceability and support informed decision-making throughout building lifecycles (Zhang et al., 2024).

4.1 Environmental and Economic Benefits of Circular Supply Chains

Environmental Benefits

Circular supply chains contribute directly to environmental sustainability by enabling material recirculation and reducing dependence on virgin resources. García et al. (2024) reported that improved recovery and recycling systems can substantially decrease greenhouse gas emissions and landfill disposal rates.

The primary environmental benefits include:
- Reduced extraction of natural resources.
- Lower greenhouse gas emissions.
- Improved resource efficiency.
- Reduced landfill dependency.
- Enhanced waste recovery rates.

Economic Benefits

From an economic perspective, circular supply chains create value by transforming waste into secondary resources. Material recovery reduces procurement costs and creates opportunities for secondary material markets. According to García et al. (2024), organizations implementing circular supply chains may benefit from:
- Reduced raw material costs.
- Improved supply chain resilience.
- New revenue streams from recovered materials.
- Reduced waste management expenditures.
- Increased competitiveness through sustainable business models.

Table 3. Environmental and Economic Benefits of Circular Supply Chains

Dimension	Key Benefits
Environmental	Reduced emissions, landfill diversion, resource conservation
Economic	Cost savings, resource recovery, new market opportunities
Operational	Improved traceability, material efficiency, risk reduction
Strategic	Enhanced resilience and regulatory compliance

Table 3 summarizes the main benefits of circular supply chains across four dimensions. Environmentally, circular approaches help reduce greenhouse gas emissions, divert waste from landfills, and conserve natural resources by keeping materials in use for longer. Economically, they lower costs through improved resource efficiency and recovery, while also enabling new revenue streams from reused or recycled materials and emerging circular business models. Operationally, circular systems enhance traceability of materials, improve overall material efficiency, and reduce risks related to supply disruptions or resource scarcity. Strategically, they strengthen long-term resilience and help organizations comply more easily with evolving environmental regulations and sustainability requirements.

Barriers to Circular Supply Chain Implementation

Despite their advantages, several barriers continue to limit adoption.

Table 4. Major Barriers and Potential Solutions

Barrier	Potential Solution
Lack of recycling infrastructure	Government investment and incentives
Poor material traceability	BIM and Digital Product Passports
Regulatory uncertainty	Standardized circular economy policies
Quality concerns	Certification and quality assurance systems
Stakeholder resistance	Training and awareness programs

Table 4 summarizes the primary challenges hindering the implementation of circular supply chains in the construction industry and identifies corresponding mitigation strategies. The findings indicate that both technological and institutional barriers must be addressed to achieve successful circular economy adoption. In particular, investments in digital technologies such as Building Information Modeling (BIM) and Digital Product Passports can improve material traceability, while regulatory frameworks and certification systems can increase confidence in recycled materials. Addressing these barriers is essential for scaling circular construction practices in urban development projects.

The literature suggests that overcoming these barriers requires coordinated efforts among governments, industry stakeholders, and researchers. Policy support, technological innovation, and improved collaboration are essential for enabling large-scale implementation of circular supply chains in urban construction projects.

4.2. Discussion

The purpose of this study was to evaluate the environmental and economic impacts of adopting circular economy practices in urban construction projects through the management of construction and demolition waste (CDW). Specifically, the study examined the recycling and reuse of construction materials, assessed the environmental performance of recycled concrete and steel using life cycle assessment (LCA), and analysed the role of sustainable supply chains in facilitating circular economy implementation. The findings indicate that circular economy strategies can substantially improve resource efficiency while generating both environmental and economic benefits within the construction sector.

The first objective was to examine how recycling and reuse strategies contribute to sustainability in urban construction projects. The literature consistently demonstrates that construction and demolition waste should be viewed as a valuable resource rather than a disposal problem. Recycled aggregate concrete and recovered steel materials reduce dependence on virgin raw materials, minimise landfill disposal, and support resource conservation efforts (Wang et al., 2022). These findings align with circular economy principles, which emphasise maintaining materials at their highest value for as long as possible through reuse, recycling, and recovery processes (Geissdoerfer et al., 2017). The evidence suggests that increasing the utilisation of recycled construction materials can significantly contribute to reducing the environmental footprint of urban development projects.

The second objective focused on assessing the environmental performance of recycled concrete and recycled steel through life cycle assessment methodologies. The reviewed studies indicate that recycled materials generally outperform virgin materials across several environmental impact categories, including greenhouse gas emissions, resource depletion, and waste generation (Bayram & Greiff, 2023). Recycled aggregate concrete was found to reduce aggregate extraction and landfill dependency, while recycled steel demonstrated particularly strong environmental performance due to its high recyclability and lower energy requirements during production (Marrucci et al., 2025). However, the literature also highlights that factors such as transportation distances, recycling technologies, and regional energy sources influence LCA outcomes. Therefore, while recycled materials provide clear environmental advantages, their sustainability performance depends on local conditions and effective waste management infrastructure.

The third objective examined the role of sustainable supply chains in supporting circular economy implementation. The findings reveal that circular supply chains are essential for enabling material recovery and reuse across construction project lifecycles. Unlike traditional linear supply chains, circular systems facilitate resource circulation through collaboration among contractors, suppliers, demolition firms, recyclers, and policymakers (Kirchherr et al., 2018). Furthermore, emerging technologies such as Building Information Modelling (BIM), digital product passports, and blockchain-based tracking systems have the potential to improve material traceability and support informed decision-making throughout the building lifecycle. These technologies can strengthen supply chain transparency and increase the efficiency of material recovery processes.

From an environmental perspective, the reviewed literature demonstrates that circular economy practices contribute significantly to climate change mitigation and resource conservation. Reduced extraction of virgin materials lowers ecosystem disturbance, while increased recycling and reuse decrease landfill disposal and associated environmental impacts (García et al., 2024). These findings support previous research indicating that circular construction practices can play an important role in achieving global sustainability and carbon reduction targets.

From an economic perspective, the adoption of circular economy strategies can generate considerable value for construction stakeholders. Material recovery reduces procurement costs, improves resource productivity, and creates opportunities for secondary material markets (García et al., 2024). Additionally, circular supply chains can enhance resilience against fluctuations in raw material prices and supply disruptions. Although the transition toward circular construction may require initial investments in recycling infrastructure and digital technologies, the long-term economic benefits appear to outweigh these costs.

Despite these advantages, several barriers continue to hinder widespread implementation. The literature identifies inadequate recycling infrastructure, regulatory inconsistencies, concerns regarding material quality, and limited stakeholder awareness as major challenges (Bayram & Greiff, 2023). Consequently, successful implementation of circular economy practices will require stronger policy support, industry collaboration, technological innovation, and investment in material recovery systems. Addressing these barriers is essential for scaling circular construction practices and maximising their environmental and economic benefits.

5. CONCLUSION

This study investigated the environmental and economic impacts of adopting circular economy practices in urban construction projects through construction and demolition waste management strategies. The findings demonstrate that recycling and reusing construction materials, particularly concrete and steel, contribute significantly to resource conservation, waste reduction, and greenhouse gas emission mitigation. Life cycle assessments further confirm that recycled materials generally exhibit superior environmental performance compared to virgin materials, supporting their integration into sustainable construction practices.

The study also highlights the critical role of sustainable supply chains in enabling circular resource flows. Through effective material recovery systems, stakeholder collaboration, and the adoption of digital technologies, circular supply chains can improve resource efficiency while creating economic value. These systems support both environmental sustainability and long-term economic resilience within the construction sector.

5.1 Answer to the Research Question

The research question asked:
What is the environmental and economic impact of adopting circular economy practices in urban construction projects?

Based on the literature reviewed, the adoption of circular economy practices generates substantial environmental benefits through reduced carbon emissions, decreased resource extraction, lower landfill disposal rates, and improved resource efficiency. Economically, circular economy implementation contributes to cost savings, material value recovery, enhanced supply chain resilience, and the development of secondary material markets. Therefore, circular economy strategies represent an effective approach for improving both environmental sustainability and economic performance in urban construction projects.

5.2 Recommendations for Future Research

Future research should focus on:
1. Developing standardised frameworks for measuring circular economy performance in construction projects.
2. Conducting empirical case studies that quantify the long-term economic benefits of circular construction practices.
3. Investigating the effectiveness of digital technologies such as BIM, digital product passports, and blockchain systems in supporting material traceability and recovery.
4. Examining policy mechanisms and regulatory frameworks that can accelerate circular economy adoption across different regions.
5. Exploring social sustainability dimensions, including employment creation and stakeholder engagement, within circular construction systems.

REFERENCE

Bayram, B., & Greiff, K. (2023). *Life cycle assessment on construction and demolition waste recycling: A systematic review analyzing three important quality aspects*. The International Journal of Life Cycle Assessment, 28, 967–989.
https://doi.org/10.1007/s11367-023-02145-1

European Commission. (2024). *Construction and demolition waste*.
Available at:

https://environment.ec.europa.eu/topics/waste-and-recycling/construction-and-demolition-waste_en

García, J. C., Caro, D., Foster, G., Pristera, G., Gallo, F., & Tonini, D. (2024). *Techno-economic and environmental assessment of construction and demolition waste management in the European Union*. European Commission Joint Research Centre.
Available at: https://circulareconomy.europa.eu/platform/en/knowledge/techno-economic-and-environmental-assessment-construction-and-demolition-waste-management-european-union

Geissdoerfer, M., Savaget, P., Bocken, N. M. P., & Hultink, E. J. (2017). The circular economy – A new sustainability paradigm? *Journal of Cleaner Production, 143*, 757–768. https://doi.org/10.1016/j.jclepro.2016.12.048

International Organization for Standardization (ISO). (2006). *ISO 14040: Environmental management—Life cycle assessment—Principles and framework*. Geneva, Switzerland: ISO.
Available at:https://www.iso.org/standard/37456.html

Kirchherr, J., Reike, D., & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, Conservation and Recycling, 127*, 221–232.
DOI:
https://doi.org/10.1016/j.resconrec.2017.09.005

Marrucci, L., Daddi, T., & Iraldo, F. (2025). Boosting circular economy solutions in the construction sector using life cycle assessment. *Journal of Industrial Ecology, 29*(2), 473–485. https://doi.org/10.1111/jiec.13614

Mesa, J. A., Fúquene-Retamoso, C., & Maury-Ramírez, A. (2021). Life cycle assessment on construction and demolition waste: A systematic literature review. *Sustainability, 13*(14), 7676. https://doi.org/10.3390/su13147676

United Nations Environment Programme (UNEP). (2023). *Building materials and the climate: Constructing a new future*.
https://www.unep.org/resources/report/building-materials-and-climate-constructing-new-future

Wang, J., Liu, J., et al. (2022). Life cycle assessment of recycled aggregate concrete on its environmental impacts: A critical review. *Construction and Building Materials, 317*, 125950. https://doi.org/10.1016/j.conbuildmat.2021.125950

Xuan, D., Zhan, B., & Poon, C. S. (2019). A review of life cycle assessment of recycled aggregate concrete. *Construction and Building Materials, 209*, 115–125. https://doi.org/10.1016/j.conbuildmat.2019.03.078

Zhang, Y., et al. (2024). Comparative life cycle assessment of natural and recycled aggregate concrete: A review. *Science of the Total Environment, 950*, 175310. https://doi.org/10.1016/j.scitotenv.2024.175310