

# Construction project management with a circular economy and waste minimisation focus: A bibliometric analysis of its evolution and research trends

Gestión de proyectos de construcción con enfoque de economía circular y minimización de residuos: análisis bibliométrico de su evolución y tendencias de investigación

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Fecha de Recepción: 05/01/2026

Fecha de Aceptación: 02/03/2026

Fecha de Publicación: 02/04/2026

PAG: 1-17

## Abstract

Material cycle management in construction projects drives emissions and value losses, while demolition and site waste flows exceed disposal capacity in several markets. This study aimed to describe and quantitatively analyse the evolution of the literature on circular practices applied to project management and their relationship with waste prevention and valorisation. We conducted bibliometric mapping in Scopus. The search on 23/12/2025 retrieved 814 records from 2001 to 2026, analysed using Bibliometrix 5.1.1, VOSviewer 1.6.20, and RPYS. The corpus includes 230 sources and shows 9.65% annual growth, with 465 articles and 126 reviews. It involves 2,680 authors, 7.89 co-authors per document, and 27.4% international co-authorship. The average impact reaches 24.35 citations per document, with 1,972 author keywords and 5,645 references. Output concentrates from 2020 to 2025 with 749 documents, representing 92.0% of the total, and peaks in 2025 with 245 documents. The thematic map positions waste management and demolition as motor themes, alongside life cycle assessment, BIM, recycled materials, and digital tools. The findings highlight the priority of early decisions in design, procurement, and end of life to reduce material losses and improve traceability.

**Keywords:** BIM; Circular Economy; Construction and Demolition Waste; Life Cycle Assessment; Project Management.

## Resumen

La gestión del ciclo de materiales en proyectos determina emisiones y pérdidas de valor, mientras los flujos de demolición y obra superan la capacidad de disposición en varios mercados. Este estudio tuvo como objetivo describir y analizar cuantitativamente la evolución de la literatura sobre prácticas circulares aplicadas a la dirección de proyectos y su relación con prevención y valorización de desechos. Se aplicó cartografía bibliométrica en Scopus. La búsqueda del 23/12/2025 recuperó 814 registros 2001-2026, analizados con Bibliometrix 5.1.1, VOSviewer 1.6.20 y RPYS. El corpus abarca 230 fuentes y crecimiento anual 9,65%, con 465 artículos y 126 revisiones. Participan 2680 autores, 7,89 coautores por documento y 27,4% de coautoría internacional. El impacto medio alcanza 24,35 citas por documento, con 1972 palabras clave de autor y 5645 referencias. La producción se concentra en 2020-2025 con 749 documentos, 92,0% del total, con pico en 2025 con 245. El mapa temático posiciona gestión de desechos y demolición como temas motores, junto con evaluación del ciclo de vida, BIM, materiales reciclados y herramientas digitales. Los hallazgos señalan prioridad en decisiones tempranas de diseño, compras y fin de vida para reducir pérdidas materiales y mejorar trazabilidad.

**Keywords:** BIM; Economía Circular; Evaluación de Ciclo de Vida; Gestión de Proyectos; Residuos de Construcción Y Demolición.

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## 1. Introduction

Construction underpins much of the infrastructure used by the economy and concentrates substantial demand for materials and energy (Abiodun et al., 2026). At the global scale, in-use stocks of materials in buildings and infrastructure increased 23-fold between 1900 and 2010, reaching 792 Gt, and they are estimated at 1239 Gt in 2024. Their maintenance and expansion, therefore, require around 50% of annual resource use (Krausmann et al., 2017; Ranjbar et al., 2026). This intensifies extraction, transport, and material manufacturing, and amplifies climate and environmental impacts from early stages of the project life cycle assessment (LCA) (Alghamdi, 2025).

Within this material profile, cement stands out for its climate burden. A global assessment of cement emissions reports that the sector contributes around 7 to 8% of global CO<sub>2</sub> when process and energy emissions are combined, with strong dependence on clinker production and associated thermal energy demand (Andrew, 2019; Baggio et al., 2024). In the same direction, technological options in materials show measurable abatement margins. For example, an experimental and assessment study reports reductions of up to 45.5% in energy and 35.1% in CO<sub>2</sub> when using alternative clinkers compared with Ordinary Portland Cement (OPC) clinker, with direct implications for technical specifications and project procurement (Williams & Yang, 2024). These results highlight a key point for project management. When the team selects materials, suppliers, and execution methods without circularity criteria, it locks in emissions and waste before construction starts (Grigoryan & Daskalakis, 2025).

The waste problem becomes critical due to both volume and heterogeneity. In the European Union, construction and demolition waste exceeds 450 million t/year, and even when soil and road excavation are excluded, the flow is estimated at around 180 million t/year (Naraian et al., 2025; Sohoo et al., 2025). These volumes saturate disposal capacity and increase management costs when projects do not plan for them from the outset (Calcagni et al., 2025). In China, annual construction and demolition waste output exceeds 1.5 Gt/year (Dong et al., 2025). In 2024, a recycling rate close to 10% is reported, with major gaps in treatment infrastructure and operational control, which increases dumping and material value losses (Wu et al., 2025). These figures show a repeated pattern in which the sector produces massive flows and, when management fails, most ends as discard rather than as a resource (Dziedzic et al., 2025).

The circular economy seeks to curb these losses through measurable actions in prevention, reuse, and high-value recycling (Anand & Anand, 2026). On-site and across construction systems, several approaches already show quantified effects. In Hong Kong, a comparative study reports an average reduction in material wastage of about 52% when using prefabrication rather than conventional construction, with direct implications for waste generation and project logistics (Kang & Tan, 2025; Zhu & Fan, 2023). Similarly, an American Society of Civil Engineers (ASCE) study reports that buildings adopting modular construction reduce total construction waste by about 80% compared with traditional approaches, indicating strong potential when projects manage design, supply, tolerances, and assembly as an integrated system (Zhang et al., 2024). Such reductions require contract choices, scheduling, quality control, and coordination with manufacturers, all within project management (Yang et al., 2025).

Digitalisation also provides measurable tools to prevent waste before construction. One study reports that Building Information Modelling (BIM) used for design validation and coordination can prevent 4.3 to 15.2% of construction waste by reducing late changes, rework, and quantity errors (HaithierAli & Gopakumar, 2025; Otasowie et al., 2026). Related work describes and tests BIM-based automated methods to estimate waste, supporting handling budgets, on-site segregation, and minimisation scenarios from the planning stage (Cheng et al., 2025). A BIM framework has also been proposed to guide waste minimisation through design decisions, quantities, and management strategies by linking the model to project rules and information flows (Belkhiri et al., 2025). Operationally, these gains translate into less transport, fewer material purchases, reduced storage, and lower pressure on disposal (Flores Lara et al., 2025).

At the end of life, circularity requires a shift from undifferentiated demolition to deconstruction and selective demolition, supported by social and environmental metrics (Falsafi et al., 2025). An Italian study using regional primary data and an integrated assessment reports that a best-practice scenario with selective demolition and higher recycling could save about 18 million kg CO<sub>2</sub>-eq/year relative to current practice and generate an additional 1000 job-equivalents, although with higher conventional costs concentrated in the selective phase (Casale et al., 2025; Iodice et al., 2021). This evidence links circularity to stakeholder management, cost structures, incentives, and sequencing, which sit at the core of project management (X. Yu et al., 2025).

Project focus also matters because the footprint shifts. In new buildings, embodied emissions can account for about 20 to 25% of life-cycle emissions, and this share rises as operational energy falls through efficiency; this increases the importance of controlling impacts across materials,

processes, and supply chains (Cheng et al., 2025; Röck et al., 2020). From a climate-policy perspective, an industrial ecology analysis reports that material efficiency and sufficiency could reduce residual emissions in residential buildings towards 2050 by 27 to 31%; this supports strategies such as extending service life, reuse, design for disassembly, and reducing construction losses (Obianyo et al., 2026; Pauliuk & Heeren, 2021; Vergés et al., 2026). These values provide a clear quantitative frame in which the project becomes the decision unit that determines material inputs, waste, recovery, and embodied emissions (Alabdulrazzaq et al., 2025).

This perspective aligns with the Sustainable Development Goals. SDG 12, Responsible consumption and production, includes Target 12.5, which seeks to substantially reduce waste generation through prevention, reduction, recycling, and reuse (David et al., 2025; Javed et al., 2025). SDG 11, Sustainable cities and communities, includes Target 11.6, which aims to reduce cities' per capita environmental impact, with emphasis on municipal waste management and air quality (HaitherAli & Gopakumar, 2025). SDG 13, Climate action, includes Target 13.2, focused on integrating climate measures into policies, strategies, and planning («International Conference on Technological Innovations in Multidisciplinary Engineering and Sciences, TIMES 2024», 2025). Project management links these targets to verifiable choices in design, procurement, delivery, and end of life (Amoudi et al., 2025).

Understanding how this field has developed, to design interventions that reduce waste and improve resource use across the project life cycle, requires a broad view of theoretical and methodological progress over the past three decades. This motivates the central research question: What is the level of scientific development in construction project management with a circular economy and waste minimisation focus, and how has it evolved? From this, twelve specific questions follow: (i) How has scientific output on construction project management, the circular economy, and waste minimisation changed over time? (ii) Which document types dominate, and what is their share over the study period? (iii) Which Scopus subject areas are most associated with the topic, and how are they distributed? (iv) Which institutions and countries lead, and what are their relative contributions? (v) Which authors are most influential, and how do their careers and collaborations differ? (vi) To what extent does author productivity follow Lotka's law, and what does this indicate about the concentration of scientific leadership? (vii) Which journals account for the largest share of dissemination in this field? (viii) How is the journal core structured under Bradford's law and its dissemination zones? (ix) What is the level of international collaboration across countries and institutions? (x) What does Reference Publication Year Spectroscopy (RPYS) show about historical roots and peak-impact years? (xi) Which seminal publications, methods, or regulatory frameworks explain the RPYS citation peaks? (xii) Which trends and emerging lines shape the future agenda, based on keyword dynamics and the thematic map? Based on these questions, the general aim is to describe and quantitatively analyse the evolution of research on construction project management with a circular economy and waste minimisation focus, identifying temporal, geographical, and thematic patterns, collaboration networks, and influential sources to support decision-making and the uptake of circular practices in project management.

The remainder of this paper is organised as follows. Section 2 details the bibliometric design, including data source selection, search strategy, metadata cleaning, and analytical procedures. Section 3 presents the empirical results on production dynamics, authorship structure, source concentration, geographical and institutional distribution, thematic evolution, and historical citation roots. Section 4 interprets these findings through a policy and project-management lens, with emphasis on the mechanisms that drive current thematic priorities. Section 5 closes the paper by synthesising the main contributions, clarifying study limitations, and setting out practical, theoretical, and future research implications.

## 2. Methodology

To characterise the scientific evolution of construction project management with a circular economy and waste minimisation focus, we applied bibliometric mapping as a quantitative method grounded in mathematical and statistical models. This approach enabled us to describe scientific output, academic communication patterns, and collaboration networks within the domain of construction project management, circular economy, and construction waste, and to identify influential authors, institutions, countries, and journals.

The study followed the stages proposed by Luna-Morales et al. (2023): (i) formulating the general and specific research questions, (ii) selecting the reference database, (iii) developing a reproducible search string, and (iv) statistically analysing and visualising the retrieved metadata. We adopted an exploratory-descriptive quantitative approach with a non-experimental, longitudinal, and retrospective design to trace the literature from the earliest available records to 2025 and to identify temporal trajectories, turning points, and thematic consolidation (Bellido-Valdiviezo et al., 2023; García et al., 2025).

Based on the research question, we developed the following search string, integrating the most representative terms of the thematic domain: ( TITLE-ABS-KEY ( "construction project\*" OR "construction project management" OR "construction management" OR "construction industry" OR "building construction" ) AND TITLE-ABS-KEY ( "circular econom\*" OR circularity OR "resource circularity" OR "closed loop" ) AND TITLE-ABS-KEY ( "construction waste" OR "construction and demolition waste" OR "C&D waste" OR "demolition waste" OR "waste minimization" OR "waste reduction" OR "waste management" OR "material efficiency" ) ).

The search was run on 23 December 2025 and retrieved 814 records, with no language or time restrictions to maximise field coverage. We also included 2026 early access documents because they already had active DOIs and were therefore suitable for capturing emerging trends linked to 2026. We used Scopus as the reference database due to its multidisciplinary coverage, thematic filters, and consistent metadata, which support analyses of authors, affiliations, journals, countries, and collaboration networks. The search string was designed to focus the corpus on construction project management, the circular economy, and waste minimisation, while excluding records outside the construction sector or in non-comparable contexts to preserve thematic coherence.

Records were exported in CSV format for statistical processing. We then manually cleaned the metadata to remove duplicates and non-relevant documents, ensuring corpus specificity. The final dataset was organised in Microsoft Excel for normalisation and quality control (Osemwegie et al., 2023).

We conducted the bibliometric analysis using Bibliometrix 5.1.1 (2025) in R and VOSviewer 1.6.20 (2023). Bibliometrix was used to compute productivity indicators (authors, countries, journals), impact metrics (citations and h, g, and m indices), and collaboration measures (co-authorship and institutional links), and to apply Lotka's and Bradford's laws (Aria & Cuccurullo, 2024). VOSviewer supported the construction and visualisation of keyword co-occurrence, co-authorship, and bibliographic coupling networks, using density maps and association strength normalisation (Sulphey et al., 2024; Van Eck & Waltman, 2024). We also applied RPYS to identify historical roots and citation peaks marking milestones in the evolution of the circular economy and waste minimisation within construction project management. Together, these methods describe the field's intellectual structure, thematic evolution, and international collaboration patterns.

### 3. Results

Figure 1 summarises the scope of the bibliometric corpus. The analysis includes 814 documents published between 2001 and 2026, distributed across 230 sources. The field shows an annual growth rate of 9.65%, dominated by articles (465) and reviews (126), followed by conference papers (166) and book chapters (57).

The authorship pattern confirms team-based research as the norm: 2,680 authors, no single-authored documents, and 7.89 co-authors per document, with 27.4% international co-authorship. Average impact reaches 24.35 citations per document, with a mean age of 1.93 years, indicating a recent literature with early academic uptake. The thematic content is diverse, with 1,972 author keywords supported by 5,645 references, consistent with a broad conceptual base and rapid expansion.



Figure 1. General bibliometric indicators of the corpus.

In Figure 2, annual scientific output remains marginal between 2001 and 2016, with 12 articles across the period, representing 1.47% of the corpus. From 2017, the trend shifts to sustained growth, rising from 6 articles in 2017 to a peak of 245 in 2025, a 41-fold increase relative to 2017.

Output has concentrated in recent years. Between 2020 and 2025, 749 articles were published, equivalent to 92.0% of the total, and 2025 alone accounts for 30.1%. The 2026 value reaches 10 documents and reflects the search cut-off with early access records, so the decline indicates an incomplete year rather than reduced activity.

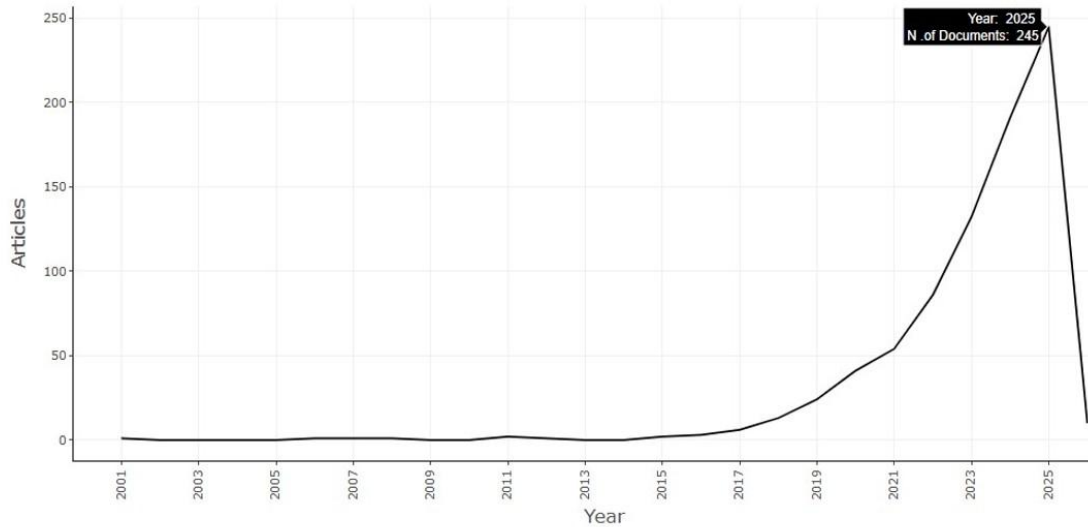


Figure 2. Annual scientific output.

Figure 3 identifies the most productive authors in the corpus. Salman Shooshtarian leads with 18 documents, followed by Tayyab Maqsood with 14 and Malik Mansoor Ali Khalfan with 11. A second group includes Savindi Caldera, Tim John Ryley, and Peter S.P. Wong, each with 10 documents. Ferhat Karaca has 9, Kofi Agyekum and Nilupa Udawatta have 8, and Prince Antwi-Afari has 7.

The 7 to 18 document range indicates productive leadership without extreme dominance, consistent with a field shaped by multiple contributors. When weighted by contribution, Shooshtarian remains first with 4.47 fractionalised articles, while Udawatta stands out with 2.25 across 8 documents, aligning with the high co-authorship observed in the dataset.

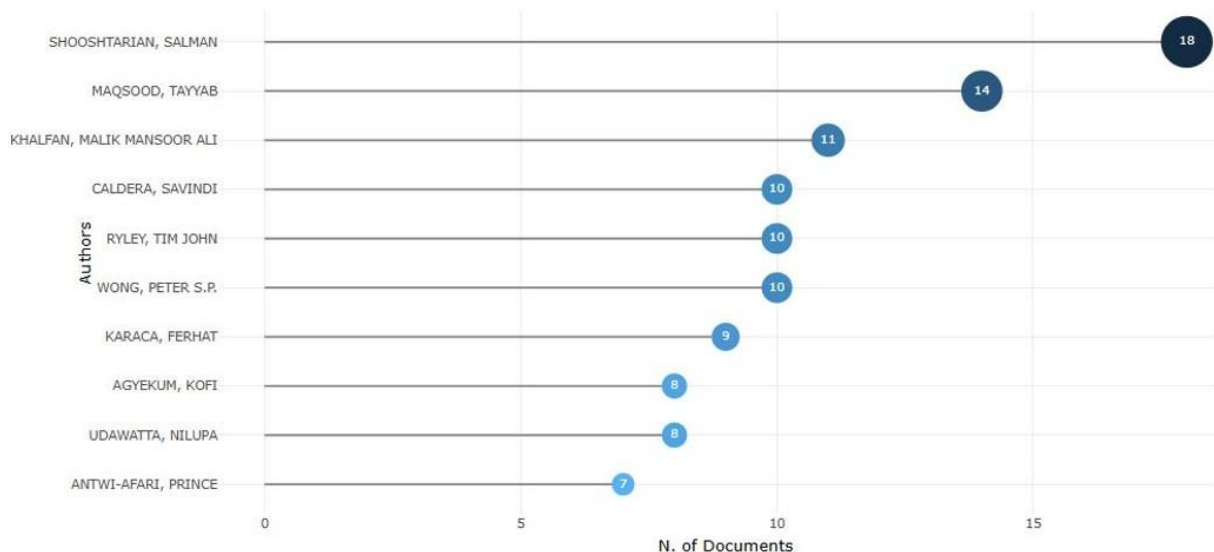


Figure 3. Relevant authors.

Figure 4 presents the distribution of author productivity and its comparison with Lotka's law. The corpus relies on one-off contributions. Authors with a single document account for 86.1%, equivalent to 2,209 out of 2,567 authors. Authors with two documents represent 8.8%, with 226 authors. From three documents onwards, the share falls to 2.8% with 72 authors, and from four documents it drops to 1.1% with 27 authors.

The observed curve concentrates more single-publication authors than the theoretical curve, as the model estimates 63.8% at that level. The opposite occurs in the next level. The model expects 16.0% with two documents, while the corpus records 8.8%. In terms of concentration, 33 authors, 1.3%, reach five or more documents, and only 6 authors, 0.23%, reach ten or more. This pattern describes an expanding field with high author entry and a small group sustaining continued output.

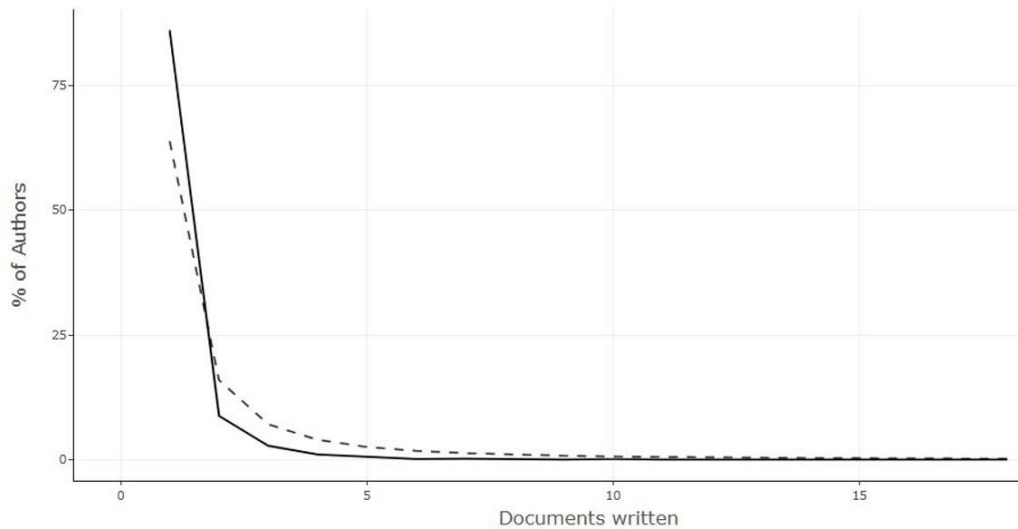


Figure 4. Author productivity distribution, Lotka's law.

Figure 5 shows that dissemination concentrates in a small set of leading sources. Sustainability (Switzerland) ranks first with 60 documents, followed by Lecture Notes in Civil Engineering with 51 and Journal of Cleaner Production with 39. Buildings follow with 34, and Resources, Conservation, and Recycling with 24. Waste Management and Research records 21, Materials 20, Journal of Building Engineering 18, and IOP Conference Series: Earth and Environmental Science 17. Together, these nine sources account for 284 documents, representing 34.9% of the total. The top three alone group 150 documents, equivalent to 18.4%.

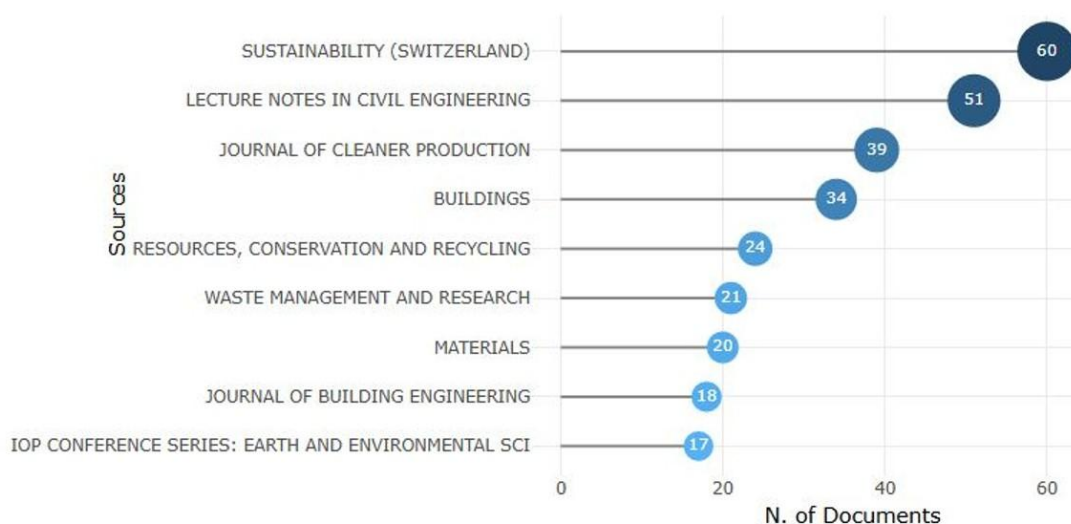


Figure 5. Leading journals.

The publishing profile shows convergence across sustainability, cleaner production, and civil engineering, with journals linking technical project decisions to circularity and waste management. The presence of conference series reinforces the role of technical venues in disseminating recent advances. The remaining output spreads across many lower-volume sources, confirming a visible publication core without restricting the debate to a few channels.

Figure 6 shows a strong concentration in a small editorial core, consistent with Bradford's law. Zone 1 groups 6 sources and 280 articles, equivalent to 34.4% of the total, drawn from 2.6% of sources. This core includes Sustainability (Switzerland), Lecture Notes in Civil Engineering, Journal of Cleaner Production, Buildings, and Resources, Conservation and Recycling, together with a set of records with no source reported in the metadata, which increases the first tier.

Dispersion then rises rapidly. Zone 2 includes 28 sources and 268 articles, 32.9% of the corpus. Zone 3 contains 196 sources and 266 articles, 32.7%, confirming a long tail of journals with occasional contributions. This pattern identifies the publication centre of the topic and where evidence fragments. It supports reading prioritisation, target-journal selection, and metadata quality checks before interpreting source rankings.

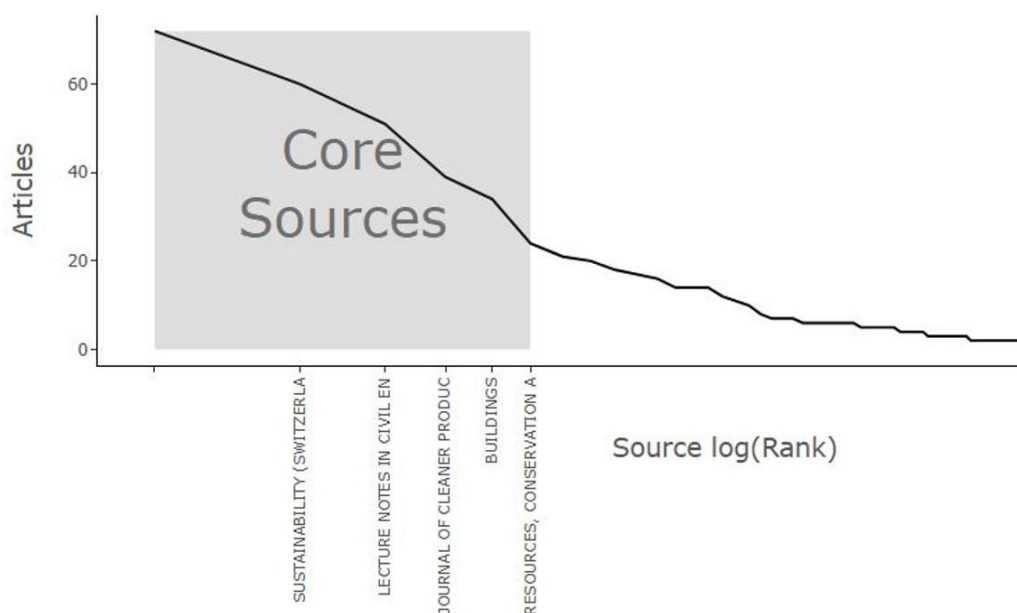


Figure 6. Article dispersion, Bradford's law.

Figure 7 reports the institutional affiliations with the highest output in the corpus. RMIT University leads with 85 articles. The Hong Kong Polytechnic University records 47, and the Universidad Politécnica de Madrid 40. Kwame Nkrumah University of Science and Technology reports 35. Deakin University and Nazarbayev University record 34, The University of Hong Kong 32, Università Politecnica delle Marche 31, University of Moratuwa 30, and Griffith University 25.

These ten institutions sum 393 affiliation records out of 3,038 affiliation records in the corpus, equivalent to 12.9%. A single article can list multiple affiliations, so institutional counts exceed the number of documents. The list combines nodes from Oceania, Asia, Europe, and Africa. Australia contributes three institutions in the top 10, and Hong Kong contributes two. RMIT's lead includes a gap of 38 articles over the second institution, indicating a consolidated research hub and collaboration networks.

Figure 8 shows a clear concentration of output by country. Australia leads with 99 documents, followed by the United Kingdom with 89, India with 80, and China with 67. Italy records 53, Spain 43, the United States 41, Portugal 39, Germany 36, and Brazil 27. These ten countries account for 574 country document records, equivalent to 50.5% of the 1,136 country document records in the dataset. One document can be linked to more than one country through international co-authorship, which is why the country total exceeds the 814 documents in the corpus.

The pattern also highlights an active European group, with Italy, Spain, Portugal, and Germany in the top 10, alongside strong hubs in Oceania and Asia. Latin America appears through Brazil as the main contributor in the chart, and Peru, with 5 documents in the country set. Coverage is broad, with 85 participating countries, but contributions are spread along a long tail. Thirty-nine countries record 5 documents or fewer, and half contribute 7 or fewer.

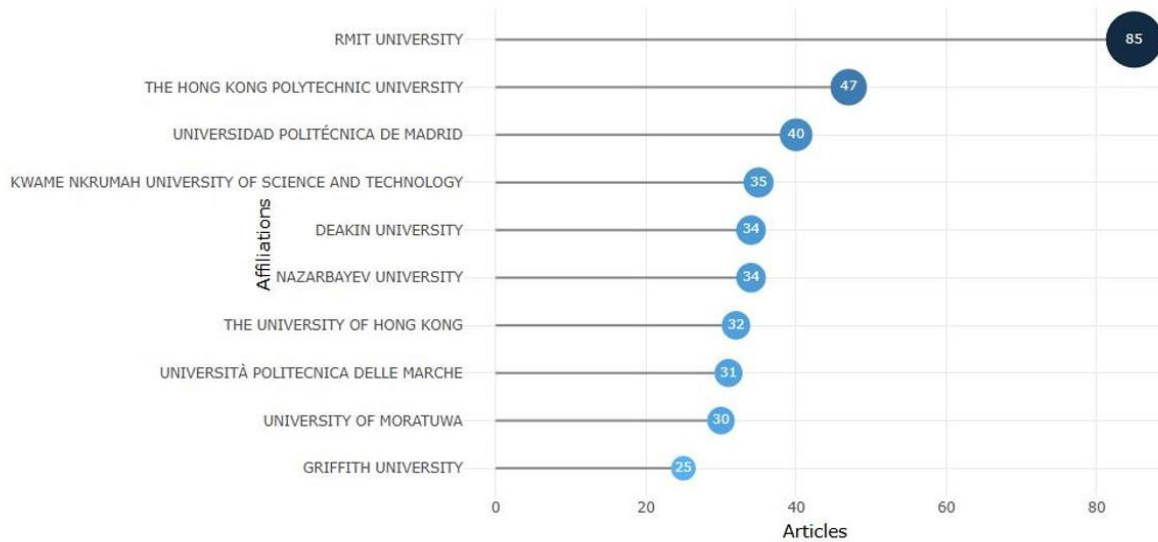


Figure 7. Institutional affiliations.

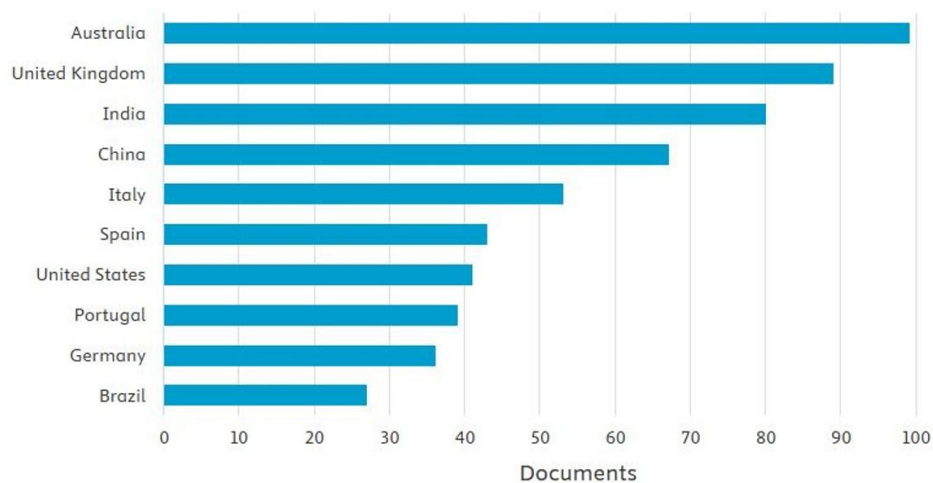


Figure 8. Output by country.

Figure 9 shows the time dynamics of the most frequent terms in the field. From 2001 to 2016, cumulative use remained almost flat. Growth begins in 2017 and accelerates sharply from 2020. Circular economy dominates recent vocabulary, rising from 32 cumulative occurrences in 2020 to 446 in 2026. The steepest increase occurs between 2022 and 2025, from 125 to 438, matching the corpus growth cycle.

Waste and sustainability terms rise in parallel but remain below the circular economy. Construction and demolition waste reached 115 cumulative occurrences in 2026, waste management 108, and sustainability 96. The construction industry reaches 77, and recycling 64, while life cycle assessment totals 38 and sustainable construction 40. Cumulative values change little in 2026 relative to 2025, consistent with early access records and an incomplete year. Overall, the agenda centres on circularity while integrating waste management, sustainability, and life-cycle approaches within project management.

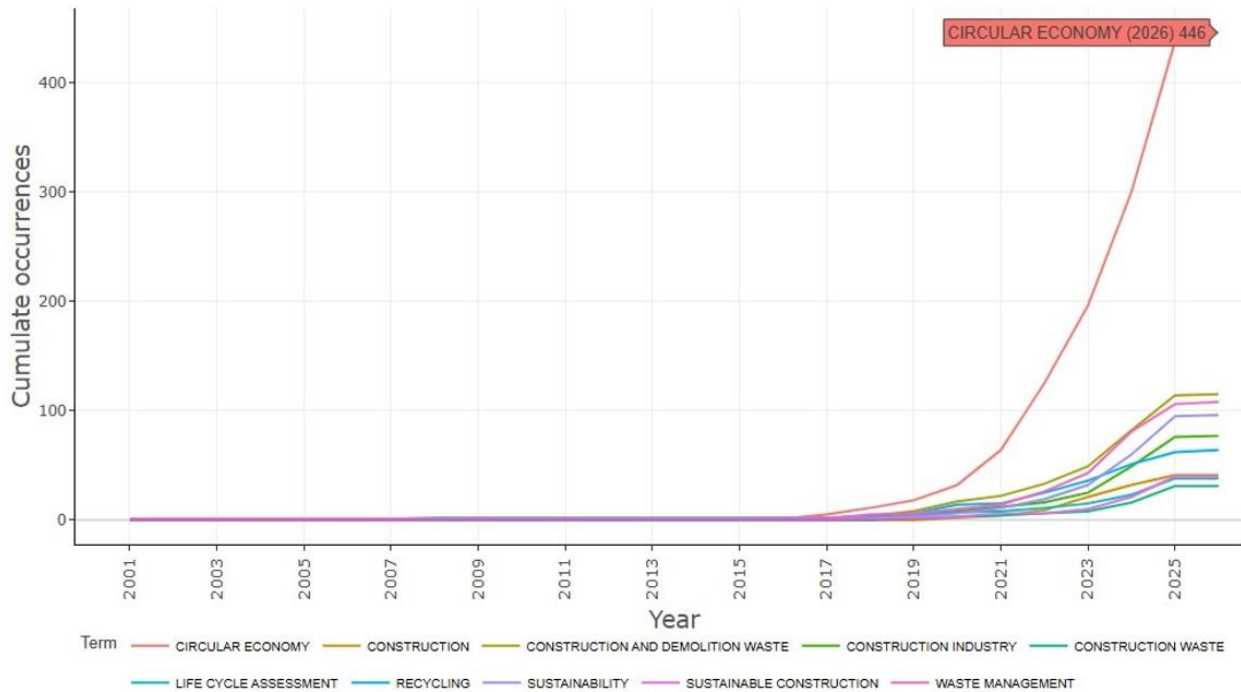


Figure 9. Word frequency over time.

Figure 10 shows the Scopus subject-area distribution, led by Engineering and Environmental Science. Engineering records 457 assignments, 27.2%, and Environmental Science 375, 22.3%, together accounting for 49.6%. Energy contributes 180, 10.7%, and Social Sciences 150, 8.9%. Materials Science records 107, 6.4%, followed by Computer Science with 96, 5.7%, and Business, Management and Accounting with 90, 5.4%.

The remainder of the top 10 includes Economics, Econometrics and Finance with 48, 2.9%, Earth and Planetary Sciences with 45, 2.7%, and Physics and Astronomy with 38, 2.3%. Other groups have 93 assignments, 5.5%, including low-frequency areas such as Mathematics and Chemical Engineering. Total assignments reach 1,679, exceeding 814 documents because Scopus assigns multiple subject areas to a single record. The pattern confirms a technical core centred on engineering and environmental science, with relevant contributions from energy and the social sciences for project decisions, sustainability, and resource management in construction.

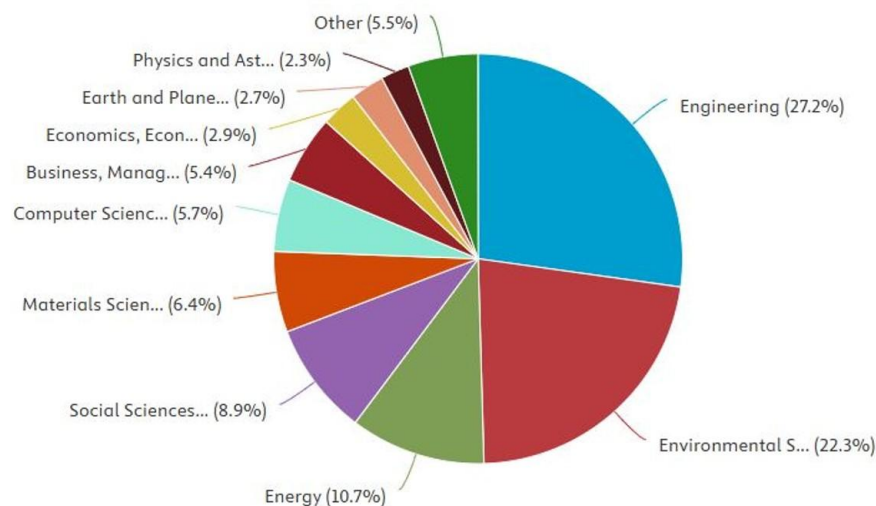


Figure 10. Publications by subject area.



Figure 13 uses two complementary metrics that should be interpreted together. Centrality on the horizontal axis measures how strongly a theme connects with other themes in the network, so it indicates strategic relevance for the field. Density on the vertical axis measures the strength of links within the theme itself, so it indicates internal development and conceptual maturity. In project management terms, centrality reflects cross-phase influence on design, procurement, logistics, contract strategy, and end-of-life planning, while density reflects methodological depth inside a specialised topic. Motor themes combine high centrality and high density, basic themes combine high centrality with lower density, niche themes combine lower centrality with high density, and emerging or declining themes show low values on both axes.

The motor-themes quadrant groups the construction industry, waste management, and demolition. This cluster includes 3,574 occurrences across 117 terms, representing 54.9% of total occurrences. It defines the field's operational axis: waste management in construction, demolition, and recycling, with strong internal cohesion and direct links to the wider network.

The cluster around circular economy, sustainable development, and life cycle appears as a basic theme. It comprises 2,315 occurrences and 92 terms, 35.6% of the total. It functions as a cross-cutting frame linking life-cycle and sustainability debates to project management and the waste agenda, though with lower internal density than the motor cluster.

In the niche-themes quadrant, the materials performance cluster includes concrete aggregates, compressive strength, and concretes. It contributes 616 occurrences across 41 terms, equivalent to 9.5% of total occurrences. This cluster is classified as niche because it is internally coherent yet less connected to broader project-management themes such as governance, procurement pathways, demolition logistics, and system-level circularity integration. By contrast, waste management is a motor theme because it combines high internal cohesion with strong links to demolition, recycling, circular economy, life cycle assessment, and delivery decisions across the project life cycle.

## 4. Discussion

The temporal dynamics of the corpus suggest that research has moved from marginal interest to an adoption-oriented phase within project practice (Abiodun et al., 2026). The growth break shown in Figures 1 and 2 aligns with the integration of climate targets and material-efficiency goals into policy agendas and corporate strategies (Emami et al., 2026). This shift makes early project decisions decisive, because design choices, procurement, and programme planning define waste generation and recovery options before construction starts (Mattersberger et al., 2026; B. Yu et al., 2026). In this setting, the literature is most useful when it quantifies effects on cost, schedule, environmental performance, and operational risk through comparisons against explicit baselines, with clear boundary conditions for implementation (Alghamdi, 2025).

Authorship patterns indicate a networked domain with distributed contributions; Figures 1, 3, and 4 reflect shared leadership, a wide base of authors with one-off outputs, and a small core with sustained production (Alabdulrazzaq et al., 2025; Flores Lara et al., 2025). This configuration speeds up methodological diffusion and interdisciplinary entry, but it also fragments definitions of circularity, waste, recycling, and efficiency across studies (Kazmi & Jain, 2025). To build comparable evidence, studies should harmonise indicators, state system boundaries, and disclose assumptions on data quality and context, including local treatment capacity, disposal prices, and supply-chain maturity (Aghimien et al., 2025). Without this transparency, reported percentage improvements remain hard to interpret across procurement models and regulatory settings (Javed et al., 2025).

The editorial pattern reinforces this interpretation; Figures 5 and 6 show a compact journal core that concentrates discussion and supports methodological stabilisation, alongside a long tail of sources where conference proceedings often present early proposals and emerging tools (Baggio et al., 2024; Mahmoodi et al., 2025). This dual channel supports innovation, yet it demands care when translating findings into policy instruments or project guidance, because part of the evidence still needs validation on site and across supply chains (Gurusinghe et al., 2025). Metadata cleaning also matters, since records with missing sources distort journal productivity and can bias conclusions about where the field consolidates (Kavalarakis et al., 2025).

Part of the acceleration observed in Figures 2, 7, and 8 is policy-driven. In Europe, the Waste Framework Directive and subsequent circular economy package set recovery expectations for non-hazardous construction and demolition waste and strengthened reporting duties, which increased demand for evidence on selective demolition, material traceability, and secondary material markets (Senarathne et al., 2025). This context is consistent with the high output of the United Kingdom, Italy, Spain, Portugal, and Germany. In Australia, national and state waste strategies, landfill levy settings, and recycled-content procurement signals created similar incentives, aligning with the strong role of Australian

institutions. In China and India, rapid urban expansion combined with construction and demolition waste regulation appears to have stimulated applied research on sorting systems, recycling capacity, and implementation barriers (Gurusinghe et al., 2025; Mankata et al., 2025). These regulatory contrasts help explain both growth dynamics and geographic concentration in the corpus (Yang et al., 2025).

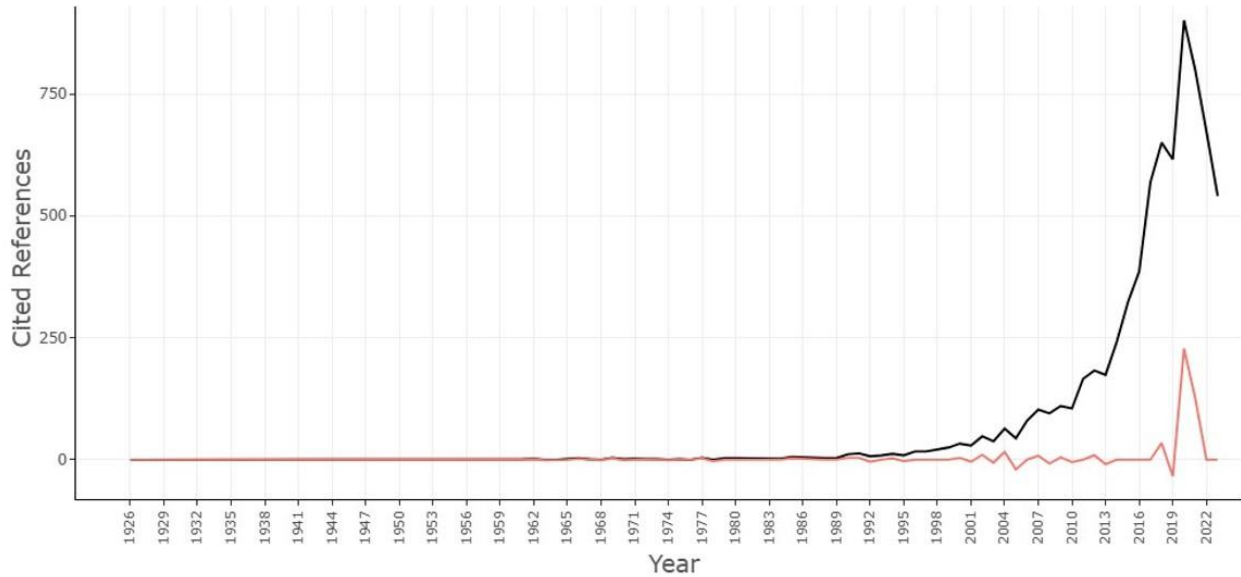


Figure 12. Annual distribution of cited references.

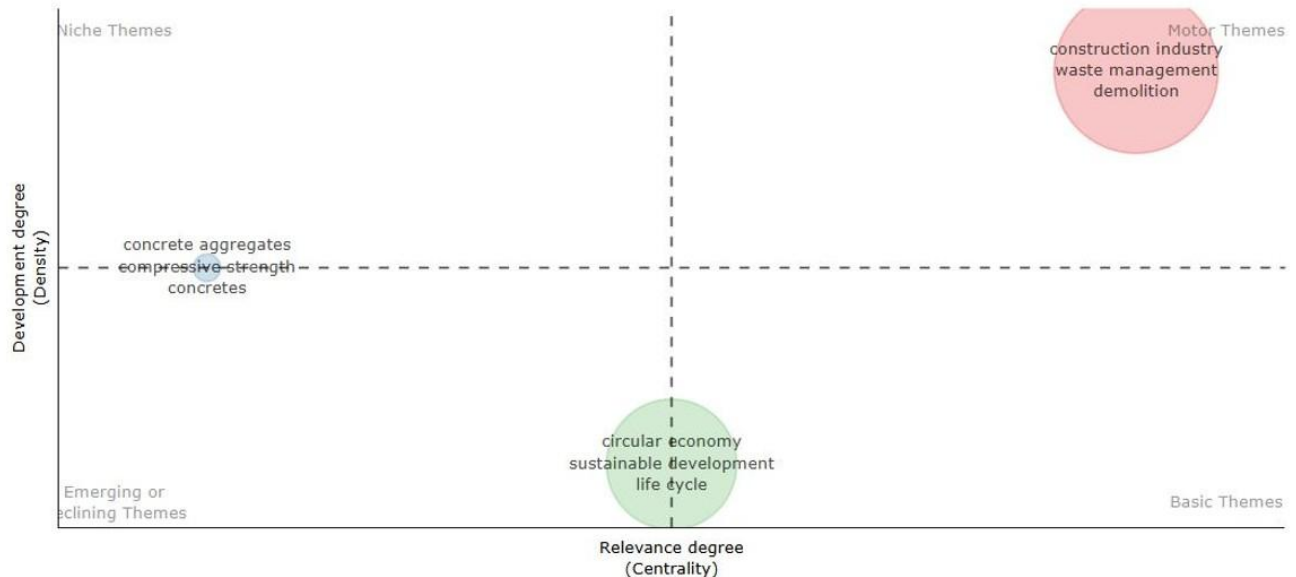


Figure 13. Thematic map.

The thematic structure integrates environmental measurement, project management, and technical solutions; Figure 9 confirms the dominance of circular economy terminology over time (Kavalarakis et al., 2025), while Figure 10 anchors the field in engineering and environmental science with support from management and energy perspectives (Senarathne et al., 2025). Figure 11 links the central axis to deconstruction, recycling,

material performance, and digital tools, indicating convergence between design-for-recovery and data-enabled control (X. Yu et al., 2025). Figure 12 points to recent high-impact roots, suggesting fast consolidation but dependence on a limited set of key contributions (Huseien et al., 2025). Figure 13 reinforces a practical priority: translate motor themes into project instruments, including contracting clauses, performance metrics, and traceability systems that support prevention and value recovery across the chain (Kazmi & Jain, 2025; Sadiq & Khalfan, 2025).

From an implementation perspective, themes with high centrality should guide portfolio-level standards and contract design, while high-density niche themes should feed technical specifications and material performance protocols (Alghamdi, 2025).

Taken together, the prominence of waste management and demolition appears to result from an interaction of five mechanisms. First, regulatory pressure has increased through landfill constraints, diversion targets, and climate compliance requirements, which push projects towards measurable recovery outcomes (García Chumacero et al., 2023). Second, economic pressure from disposal costs, material price volatility, and tighter margins makes waste prevention financially central (Carvalho et al., 2025). Third, operational priorities in project delivery, including schedule reliability, rework control, and logistics efficiency, favour strategies that reduce material losses (Garcés & Peña, 2023). Fourth, digital capabilities such as BIM-enabled quantification, LCA-linked decision support, and traceability systems improve implementation feasibility. Fifth, the gradual maturation of secondary-material markets strengthens the business case for selective demolition and valorisation pathways. This combined mechanism explains why the motor themes in Figure 13 are implementation-oriented, and why the acceleration pattern in Figure 2 coincides with a practice-facing phase of field development (Loyola & Martinez, 2025).

## 5. Conclusions

The field has expanded rapidly, with 814 documents published between 2001 and 2026 and an annual growth rate of 9.65%. Output accelerates after 2017 and concentrates in 2020 to 2025, which accounts for 92.0% of the corpus, with a peak in 2025 at 245 documents. This trajectory indicates consolidation without evidence of a post-peak decline.

Scientific production is collaborative and internationally connected, with 7.89 co-authors per document and 27.4% international co-authorship. Author productivity shows high entry, since 86.1% of authors publish one article, while a small core sustains continuity. Dissemination remains concentrated in a limited journal core, led by Sustainability, Lecture Notes in Civil Engineering, and Journal of Cleaner Production, while Bradford's distribution confirms a broad long tail.

This study has limitations that affect the scope and generalisability. The dataset is based on Scopus only, so relevant records indexed elsewhere, including regional outlets and technical literature, may be under-represented. The search strategy prioritises explicit circular economy and waste terminology, which may miss adjacent research framed with alternative vocabularies. Bibliometric mapping captures structural patterns and influence, but it does not establish the causal effectiveness of interventions in project delivery. Citation comparisons are also sensitive to exposure-time effects in recent and early-access records.

Practical implications are direct for policy and management. Public authorities can prioritise integrated regulatory packages that combine landfill disincentives, selective demolition requirements, traceability standards, and incentives for secondary-material uptake. Clients and project teams can translate motor themes into delivery controls by embedding circular KPIs in procurement, coupling BIM and LCA during early design, and assigning contractual accountability for recovery performance across the project lifecycle.

Theoretically, the field is moving from concept-centred discourse to an implementation-centred phase focused on governance of project decisions. The evidence supports an underlying mechanism in which policy pressure, economic constraints, and digital measurement capacity jointly elevate waste management and demolition to central thematic positions.

Future research should test whether the growth pattern in Figure 2 moves towards saturation and decline or continues through methodological renewal. A priority is to evaluate how artificial intelligence can reactivate lagging topics and reshape the field through computer-vision waste auditing, predictive selective-deconstruction planning, reverse-logistics optimisation, and large-scale evidence synthesis. Multi-database and multilingual designs, combined with longitudinal and quasi-experimental studies, should connect bibliometric trajectories with measured outcomes in cost, schedule reliability, landfill diversion, and embodied-carbon reduction.

## 6. Declaration of generative AI and AI-assisted technologies

AI-assisted technologies were not used during the preparation of this article. All content was carefully reviewed and edited by the author, who takes full responsibility for the manuscript.

## 7. Notes on Contributors

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