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Different Approaches from Industry to Embrace Circular Economy Activities in the Irish Construction Sector

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Executive Summary

The transition to a circular economy (CE) in the construction sector is increasingly recognised as essential for reducing resource consumption, minimising waste, and supporting decarbonisation. In contrast to the traditional linear "take–make–dispose" model, CE promotes the retention of material value across the building lifecycle through reuse, adaptability, and regeneration. This transition is particularly relevant in Ireland, where construction and demolition waste represents the largest waste stream and overall circularity rates remain significantly below the European average. Despite growing policy attention, a gap persists between circular economy ambitions and their practical implementation in the sector.

This study addresses a key evidence gap by examining how circular economy approaches are currently understood, adopted, and prioritised within the Irish construction sector. It identifies the range of CE approaches recognised by stakeholders and evaluates their relative levels of familiarity. In doing so, the research distinguishes between well-established practices, emerging strategies, and underdeveloped areas, offering a clearer understanding of how circularity is currently positioned within the sector.

A mixed-methods research design was adopted, combining qualitative and quantitative approaches. Empirical data were collected through a co-creation workshop involving over 40 stakeholders from across the construction ecosystem, including policymakers, industry professionals, academics, and non-profit organisations. Participants engaged in structured discussions and mapping exercises to identify CE approaches and assess their familiarity using a three-level scale (high, moderate, low). These insights were analysed using a systematic framework that enabled the classification and comparison of approaches across the building lifecycle.

The findings show that stakeholders recognise a broad and diverse range of CE approaches spanning all lifecycle stages—design, construction, operation and maintenance, end-of-life, and cross-cutting systems. At the design stage, key approaches include modular construction, design for disassembly, prefabrication, and sustainable material selection. Construction-stage strategies focus on waste prevention, circular logistics, and procurement practices. During the operation and maintenance stage, approaches centre on energy efficiency and lifecycle material management, highlighting the importance of optimising building performance and extending asset lifespan. End-of-life approaches include material recovery, deconstruction, and reuse systems, while cross-cutting enablers include

policy frameworks, lifecycle assessment tools, and digital technologies such as Building Information Modelling (BIM) and material passports.

While the wide range of approaches identified reflects the conceptual development of CE in the literature, their level of familiarity is not evenly developed across the sector. Strong familiarity is concentrated in material-related practices, construction-stage activities, and regulatory frameworks. These include sustainable material sourcing, the use of recycled materials, construction and demolition waste management, and compliance-driven standards, all of which are well embedded due to their operational clarity and alignment with existing policies and industry norms.

A broader set of approaches shows a developing but less consolidated level of familiarity. These include many design-related strategies—such as design for disassembly, modular construction, and prefabrication—as well as emerging practices linked to decarbonisation, including whole life carbon assessment and low-carbon material standards. Stakeholders demonstrate awareness of these approaches, but their application is not yet consistent across projects or organisations.

In contrast, approaches associated with long-term lifecycle thinking, operational performance, and system-wide coordination remain less established. This is particularly evident in the operation and maintenance phase, where strategies such as lifecycle material management and the rational use of energy receive limited attention. Similarly, cross-cutting approaches—such as lifecycle costing, integrated supply chain strategies, and systems-based approaches to circularity—are not yet widely embedded in practice.

Digitalisation emerges as a recognised but still maturing enabler of circular construction. While BIM is relatively well understood, more advanced digital approaches—such as material passports, digital data management, and AI-enabled systems—remain at an early stage of adoption. This suggests that the digital infrastructures required to support material traceability and lifecycle coordination are not yet fully integrated into industry practices.

In relation to decarbonisation, the findings indicate a growing awareness of the links between CE and climate objectives. Stakeholders are familiar with key carbon-related approaches, including embodied carbon reduction and whole life carbon assessment. However, these approaches are not yet systematically applied across the building lifecycle, pointing to an emerging but incomplete integration of circularity and decarbonisation strategies.

Overall, the findings suggest that the Irish construction sector is in a transitional phase in its move toward circularity. Stakeholders are engaging with a wide spectrum of CE approaches, but these are more firmly rooted in areas supported by existing regulations, established workflows, and immediate operational benefits. Approaches that depend on longer-term planning, lifecycle integration, digital systems, and cross-sector coordination are still developing.

Advancing the transition to circular construction will require moving beyond the identification of individual approaches toward their effective integration across the building lifecycle. This includes strengthening capacity in design for circularity, embedding lifecycle and operational practices, expanding the use of digital tools to support material traceability, and aligning policy frameworks with both circular economy and decarbonisation objectives. Greater collaboration across stakeholders and supply chains will also be essential to support the shift from fragmented practices to more coherent and integrated circular construction systems.

In conclusion, while significant progress has been made in identifying and promoting circular economy approaches in the Irish construction sector, their practical application remains at different stages of development. Addressing these gaps will be critical to enabling a more coordinated, lifecycle-oriented, and low-carbon transition in the built environment.

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1. Introduction

The concept of the circular economy (CE) has gained increasing attention in the construction sector as a pathway to reduce resource consumption, minimise waste, and retain material value across building lifecycles. CE is widely defined as a systems-oriented framework driven by design principles that aim to eliminate waste and pollution, circulate products and materials at their highest value, and regenerate natural systems (Ellen MacArthur Foundation, 2024). In contrast to the traditional linear "take–make–dispose" model, circularity seeks to maintain, reuse, and extend the life of assets while reducing dependence on finite resources.

Within the built environment, this transition implies a fundamental reconfiguration of how buildings are designed, constructed, operated, and deconstructed. The construction sector is particularly significant due to its high material intensity and waste generation. In Ireland, construction and demolition waste represents the largest waste stream, reaching approximately 9 million tonnes in 2023 (Environmental Protection Agency, 2025). Despite recent legislative advances, including the Circular Economy and Miscellaneous Provisions Act 2022, Ireland's circularity rate remains low—estimated at around 2.3%, significantly below the European Union average (Circle Economy, 2024). These figures point to a persistent gap between circular economy ambitions and their practical implementation in the sector.

While existing research has extensively mapped CE strategies and conceptual frameworks, there is a lack of empirical evidence examining the range of CE approaches currently recognised and adopted by the construction sector in Ireland. In particular, limited attention has been given to assessing the diversity of approaches within the sector and evaluating their relative uptake and familiarity. This gap is important, as the transition to circular construction depends not only on the availability of strategies but also on how they are understood, prioritised, and operationalised by industry actors.

This study identifies the range of approaches used by the Irish construction sector to engage with CE activities and examines how these approaches are understood, adopted, and positioned across the building lifecycle. It aims to develop a comprehensive understanding of the approaches currently recognised within the sector and to assess their relative uptake and levels of familiarity, thereby distinguishing between more established practices, those that are emerging, and those that remain underdeveloped.

To address this, the study adopts a mixed-methods approach to capture stakeholder perspectives and systematically map CE approaches across the construction lifecycle. This methodology is further reinforced through a structured review of relevant policy documents, peer-reviewed literature, and European Union legislative frameworks to ensure that the identified approaches are grounded in both industry practice and the broader regulatory and academic context. By combining qualitative insights,

quantitative analysis, and documentary review, the research provides an empirical basis for understanding current practices and identifying areas where further development is needed. In doing so, it contributes to bridging the gap between conceptual advances in circular economy research and their practical application within the Irish construction sector.

By linking the identification of CE approaches with their perceived familiarity, the findings provide insight into the current state of circular economy adoption in the sector and highlight priority areas for policy development, capacity building, and industry engagement to support the transition toward a more circular and low-carbon built environment in Ireland.

2. A Review of Circular Economy Approaches in Literature

CE approaches in the construction sector have evolved significantly over the past decade, progressing from fragmented practices toward more integrated and systemic frameworks. Rather than emerging as a unified model, this development reflects a series of conceptual and methodological shifts across the building lifecycle. Research increasingly captures a broad range of strategies, including technical, organisational, and digital interventions. This advancement can be understood across five key themes: (2.1) an initial focus on end-of-life waste recovery and construction and demolition waste management; (2.2) the integration of design strategies, particularly Design for X (DfX); (2.3) lifecycle-wide consolidation and recognition of systemic interdependencies; (2.4) the emergence of digitally enabled traceability and data-driven infrastructures; and (2.5) the prioritisation of circular approaches aligned with decarbonisation objectives.

2.1. End-of-Life Waste Recovery Orientation

Early research on CE in the construction sector largely emerged from efforts to address the environmental impacts of construction and demolition waste (CDW). Because the construction industry generates one of the largest waste streams globally, early sustainability research in the sector concentrated on improving CDW management practices, which later became closely associated with CE strategies (Adams et al., 2017; Akhimien et al., 2021; López Ruiz et al., 2020). Initial CE approaches were therefore primarily oriented toward improving waste management practices, particularly through recycling, material recovery, and landfill diversion (Adams et al., 2017; Akhimien et al., 2021; López Ruiz et al., 2020). Dominant approaches included CDW management plans, selective demolition practices, waste sorting infrastructures, recycling programmes, backfilling, and material recovery systems (Adams et al., 2017; Akhimien et al., 2021; López Ruiz et al., 2020).

Benachio et al. (2020) also demonstrate that early CE studies disproportionately focused on the end-of-life stage of buildings, while other lifecycle phases such as operation or construction received comparatively limited attention. Empirical analysis of policy frameworks, such as that by Giorgi (2022), similarly indicate that circular initiatives in the construction sector have prioritised waste management and recycling practices over reuse or broader resource management strategies. Within this context, circularity was often interpreted as enhancing resource efficiency at the end-of-life stage rather than transforming upstream design and construction processes. Although these interventions contributed to improved resource efficiency, they remained embedded within a largely linear production–consumption logic. As a result, early CE research in construction can be characterised as recovery-oriented, focusing primarily on downstream waste recovery rather than upstream design strategies.

2.2. Design Integration

A major conceptual shift in CE research in construction has been the growing recognition that circular principles must be integrated at the design stage of building projects. In a systematic review of 45 articles, Benachio et al. (2020) found a consistent emphasis on embedding economy considerations early in the project lifecycle. At this phase, decisions regarding structural systems and material configurations largely dictate the future potential for reuse and adaptability. Benachio et al. (2020) argue that such early-stage interventions allow for a more precise assessment of material reuse percentages and the seamless incorporation of circularity into Life Cycle Assessments (LCA).

Large systematic mappings of CE approaches illustrate this transition clearly. Charef and Lu (2022) identify 42 circular approaches across the architecture, engineering, and construction (AEC) lifecycle, with a substantial proportion concentrated within Design for X (DfX) strategies, including design for deconstruction, disassembly, adaptability, and standardisation. Similarly, Timm et al. (2023) identify 51 circular and ecodesign strategies spanning multiple levels of intervention, including product design strategies (e.g., modularity, design for disassembly, and durability), material efficiency approaches such as dematerialisation, and business model innovations including product–service systems. These mappings highlight the increasing centrality of design-oriented strategies within CE frameworks.

Across the literature, several design-based interventions consistently emerge as core CE approaches. Strategies such as design for deconstruction, design for adaptability, design for durability, and modular construction are repeatedly identified as key mechanisms for enabling material recovery and life extension (Benachio et al., 2020; Eberhardt, 2022; Gamage et al., 2024). Eberhardt (2022), for example, shows that assembly and disassembly strategies are among the most frequently cited design interventions, emphasising the importance of reversible connections and modular structural systems. Likewise, the synthesis of 148 initiatives conducted by Gamage et al. (2024) confirms that design-based strategies — particularly design for disassembly, adaptability, and manufacture and assembly — are among the most consistently reported CE practices.

This shift represents a reorientation in CE thinking within the construction sector. End-of-life performance increasingly becomes a design responsibility, and buildings are progressively conceptualised as material banks, capable of storing valuable components and materials for future reuse (Guerra et al., 2021; Lee et al., 2023; Oliveira et al., 2024).

2.3. Lifecycle Consolidation and Systemic Interdependence

Building on the increasing emphasis on design integration, recent scholarship has begun to highlight the systemic relationships between circular strategies implemented across different building lifecycle stages. Rather than functioning as isolated interventions tied to specific phases, circular approaches

are increasingly understood as mutually reinforcing practices that influence decisions throughout the entire building lifecycle.

A key contribution to this perspective is provided by Eberhardt et al. (2022), who analyse the interconnectivity between circular design and engineering strategies. Their work demonstrates that certain approaches act as enabling conditions for others. For example, assembly and disassembly strategies facilitate the recovery and high-quality reuse of building components, while strategies such as modularity and prefabrication enhance building adaptability and flexibility, thereby enabling future circular interventions.

Similarly, Gamage et al. (2024) identify 25 consolidated CE practices and analyse their interrelationships using a relationship matrix, illustrating how upstream design decisions shape downstream circular opportunities. Their findings demonstrate that early project choices—particularly design for disassembly, sustainable material selection (e.g., using less hazardous materials), and modular construction through design for manufacture and assembly—are foundational to the success of later circular strategies. For instance, the authors note that without design for disassembly, the recovery of components at the end of a building's life becomes significantly constrained, while modular construction facilitates waste minimisation and enables the reuse of components in subsequent service cycles.

This systemic perspective highlights that circular construction requires coordination across multiple actors and phases of the building lifecycle (Charef & Lu, 2022; Timm et al., 2023; Gamage et al., 2024). Circular strategies implemented during the initiation and design phases—such as design for disassembly and modularity—profoundly influence construction processes, operational flexibility, and end-of-life recovery potential (AlJaber et al., 2025; Charef & Lu, 2022). Consequently, successful implementation depends on integrated planning and cross-stakeholder collaboration across the construction value chain (Timm et al., 2023; Eberhardt et al., 2022; AlJaber et al., 2025). While owners and designers are identified as the stakeholders with the greatest influence over circular outcomes (AlJaber et al., 2025), broader coordination across supply chains and industry networks remains essential (Giorgi et al., 2022). This includes the development of new market mechanisms, business models, and collaborative practices capable of supporting lifecycle-oriented resource management and multidisciplinary coordination throughout the construction value chain (Eberhardt et al., 2022; Guerra et al., 2021; Tserng et al., 2021; Giorgi et al., 2022).

The recognition of systemic interdependence therefore represents an important conceptual deepening of CE research in the construction sector. Circular approaches are no longer understood as isolated technical solutions but as interconnected strategies embedded within broader circular construction ecosystems.

2.4. Digitally Enabled and Traceability Infrastructures

The implementation of CE strategies in the construction sector increasingly depends on digital infrastructures that support information sharing, resource traceability, and lifecycle coordination. As circular construction expands beyond isolated design strategies toward systemic lifecycle management and decarbonisation-oriented interventions, digital technologies play a critical enabling role in coordinating circular practices across project stakeholders and building lifecycle stages (Iqbal et al., 2025; Banihashemi et al., 2024).

Several studies identify Building Information Modelling (BIM), material passports, and digital platforms as key digital infrastructures supporting circular construction. According to Benachio et al. (2020) and Tserng et al. (2021), BIM enables the integration of material information, design decisions, and lifecycle performance data within a shared digital environment, allowing project teams to evaluate circular design options and material recovery potential during early project stages. Similarly, Timm et al. (2023) highlight the role of digital platforms and material databases in facilitating information exchange across supply chains and improving coordination between actors involved in construction, demolition, and material reuse.

Material passports are widely identified as one of the most important digital mechanisms for enabling circular construction. Lee et al. (2023) and Markou et al. (2025) emphasise that material passports allow the systematic documentation of building components, including their composition, location, and reuse potential. By enabling the traceability of materials over time, these systems support reuse, high-quality recycling, and the development of secondary material markets. In this way, buildings can increasingly be conceptualised as documented material banks that facilitate future circular value chains.

More broadly, emerging digital technologies associated with Industry 4.0—including artificial intelligence, Internet of Things (IoT), digital twins, and blockchain—are increasingly recognised as supporting circular construction by enabling real-time monitoring of resource flows, improving lifecycle data management, and supporting data-driven decision-making (Keles et al., 2025). According to Iqbal et al. (2025), these technologies can enhance the efficiency of circular strategies and support the optimisation of resource use and environmental performance, thereby contributing to both CE implementation and decarbonisation objectives in the built environment.

Through these capabilities, digital infrastructures facilitate the integration of circular principles at the design stage, support coordination across building lifecycle phases, and enable more effective monitoring of material flows and environmental impacts. As a result, digital technologies are increasingly viewed as critical enablers of the transition toward circular and low-carbon construction systems.

2.5. Prioritisation and Decarbonisation Alignment

As CE research in construction continues to mature, recent studies increasingly focus on prioritising circular strategies and evaluating their potential contribution to climate mitigation. This represents a shift from simply cataloguing circular approaches toward identifying those that generate the greatest environmental benefits, particularly in terms of reducing lifecycle carbon emissions in the built environment.

A comprehensive empirical study in this area is conducted by Nußholz (2023), who investigates the real-world application and decarbonisation potential of circular building strategies. The study demonstrates that approaches such as material reuse, adaptive reuse, and lifespan extension can significantly reduce embodied carbon emissions in the building sector by avoiding new material production and extending the productive life of existing buildings.

Similarly, Iqbal et al. (2025) employ Fuzzy Delphi and DEMATEL analysis to identify the most influential CE strategies for carbon reduction in construction. Their results highlight adaptive reuse, bio-based materials, and supply chain optimisation as key interventions for achieving circular and low-carbon construction systems.

AlJaber et al. (2025) further prioritise circular strategies using a Relative Importance Index, identifying several high-impact practices across project phases, including renewable energy integration as the most feasible strategy. The incorporation of renewable energy sources—such as solar energy systems—not only improves building energy efficiency but also contributes directly to decarbonisation by reducing operational carbon emissions during the building use phase while promoting reliance on renewable resources (AlJaber et al., 2025).

This methodological shift from descriptive enumeration to quantitative prioritisation and causal analysis reflects an important stage in the maturation of CE scholarship. Although large taxonomies identify different circular approaches (e.g., 42 strategies in Charef & Lu, 2022; 51 strategies in Timm et al., 2023), empirical studies increasingly converge around a core set of high-impact strategies for reducing lifecycle emissions, including design for deconstruction and disassembly, design for adaptability and flexibility, modular and prefabricated construction, reuse of materials and components, reverse logistics systems, material passports and digital traceability, and adaptive reuse of existing buildings.

This convergence suggests that CE research in construction is progressively moving from conceptual expansion toward strategic consolidation. Rather than continuously expanding the catalogue of circular practices, recent scholarship increasingly seeks to identify the strategies that deliver the greatest decarbonisation potential across the building lifecycle. In this context, CE approaches are

increasingly framed not only as resource efficiency strategies but also as critical pathways for achieving deep carbon reductions in the built environment.

2.6. Summary

The evolution of CE approaches in the construction sector reflects a clear shift from fragmented, end-of-life waste management practices toward integrated, lifecycle-oriented and system-level strategies. Early approaches were primarily focused on construction and demolition waste recovery, emphasising recycling and landfill diversion within a largely linear framework. Over time, the integration of circular principles at the design stage—particularly through Design for X (DfX) strategies—repositioned circularity as an upstream responsibility, enabling adaptability, reuse, and material recovery.

Subsequent research has further advanced this perspective by highlighting the systemic interdependencies between circular approaches across the building lifecycle. Circular construction is increasingly understood as a coordinated system requiring alignment between design, construction, operation, and end-of-life phases, supported by collaboration among multiple stakeholders. More recently, digital technologies such as Building Information Modelling (BIM), material passports, and data-driven platforms have emerged as key enablers, facilitating resource traceability, lifecycle coordination, and informed decision-making.

In parallel, the focus of CE research has shifted toward the prioritisation of high-impact strategies, particularly those contributing to decarbonisation. This has led to a convergence around a core set of approaches—such as design for disassembly, modular construction, material reuse, and adaptive reuse—that deliver significant environmental benefits across the building lifecycle. Overall, CE approaches in construction have evolved from isolated technical solutions into interconnected, digitally supported, and strategically prioritised interventions aligned with broader sustainability and climate objectives.

3. Methodology

3.1. Research Design

This study adopts a mixed-methods research design to examine how CE approaches are identified, understood, and positioned within the Irish construction sector by integrating qualitative and quantitative methods. The research is centred on a participatory co-creation workshop, designed using a structured model for cross-disciplinary co-creation workshops that conceptualises workshops as rigorous research instruments organised around three interconnected layers: preparatory and contextual elements, workshop design and execution, and evaluation and reflection (Vázquez-Mendoza et al., under revision). This framework provided a systematic foundation for capturing both the diversity of CE approaches and stakeholders' familiarity with their application.

The qualitative component employs a theory-informed, hybrid inductive–deductive analytical approach. Existing literature guided the conceptual identification of CE approaches while allowing the analysis to remain responsive to participant-generated insights emerging from the workshop. To strengthen analytical rigour, this qualitative process was further reinforced through a structured review of relevant policy documents, peer-reviewed literature, and European Union legislative frameworks, ensuring that the identification and interpretation of CE approaches were grounded not only in stakeholder perspectives but also within broader academic and regulatory contexts.

The quantitative component involves the systematic quantification of qualitative data, enabling structured comparison of both the range of CE approaches discussed and stakeholders' perceived levels of familiarity across groups. This integration of qualitative depth, documentary review, and quantitative comparison provides a robust empirical basis for assessing how circular economy approaches are currently understood and positioned within the Irish construction sector.

3.2. Stakeholder Engagement and Workshop Design

A research-informed, interactive workshop was conducted at Maynooth University on 9 June 2025. The workshop brought together over 40 stakeholders representing a broad cross-section of the Irish construction ecosystem, including policymakers, industry practitioners, academics, and professional organisations.

Participants were recruited through a targeted engagement process involving over 100 initial contacts to ensure representation across key domains of the construction lifecycle. The final cohort included representatives from:

- **Government/Regulatory:** DECC, EPA, OPW, and Enterprise Ireland.
- **Industry:** Architects, structural engineers, contractors, and waste specialists.

- **Academia:** Maynooth University, UCD, TCD, ATU, and ICHEC.
- **Non-Profit:** Irish Green Building Council (IGBC), SCSI, and the Rediscovery Centre.

Participants were organised into six groups and engaged in facilitated discussions structured around the core theme of the identification of CE approaches, barriers, and enablers

A combination of discussion, co-creation, and visual mapping techniques was used to support engagement. In particular, participants were asked to position CE approaches and elements according to their level of familiarity using a three-level scale:

- Level 1: High familiarity and practical experience
- Level 2: Moderate familiarity with partial or uneven application
- Level 3: Limited familiarity or primarily conceptual awareness

3.3. Data Collection

Multiple data sources were collected to ensure a rich and triangulated empirical dataset, including:

- Audio recordings of all group discussions
- Facilitator notes and observational records
- Visual artefacts produced during workshop activities (e.g., diagrams, annotated sheets)
- Photographic documentation of group outputs

In total, approximately 36 hours of recorded discussions across all groups were collected and transcribed, providing detailed insights into stakeholder perspectives and reasoning processes.

3.4. Data Analysis

The analysis was conducted through a structured, multi-stage process combining qualitative interpretation with quantitative aggregation.

First, all data sources were transcribed, reviewed, and consolidated into a unified dataset. A theory-informed identification process was then applied to extract CE approaches from the workshop data. This process was guided by prior literature on circular construction, which informed the conceptual definition of a “CE approach” and established inclusion criteria. This ensured a consistent and analytically grounded identification of approaches across diverse data sources, while remaining sensitive to how participants articulated these in practice.

Second, the extracted approaches were deduplicated to address variations in terminology across groups. This resulted in a consolidated and coherent list of CE approaches identified during the workshop.

Third, the approaches were organised into thematic categories using a hybrid inductive–deductive thematic analysis, following the framework proposed by Braun and Clarke (2021). While the analysis was informed by literature on CE taxonomies, categories were refined iteratively to reflect patterns

emerging from the data. The final thematic structure comprised the following lifecycle stages: *design, construction, operation and maintenance, end-of-life,* and *cross-cutting approaches applicable across all stages*. Within each stage, approaches were further grouped into thematic categories reflecting specific domains of action: Design & Planning; Materials & Resources; Construction & Waste; Systems & Processes; Energy; Digitalisation; Assessment; and Policy & Standards. This step enabled the organisation of identified approaches into analytically meaningful groups.

Fourth, familiarity levels assigned during the workshop were captured and linked to each identified approach. These values were derived from participant-generated visual mappings and systematically recorded for each group.

Fifth, the qualitative data were systematically quantified to enable comparative analysis. This involved calculating the frequency of occurrence of each approach across groups and computing an average familiarity score. Based on these averages, approaches were classified into three interpretive levels: high familiarity, moderate familiarity, and low familiarity.

Finally, an interpretive synthesis was conducted to examine relationships between types of approaches and their levels of familiarity, with particular attention to gaps between well-established practices and emerging or less familiar strategies.

To enhance validity and reliability, multiple strategies were employed. Data triangulation across diverse sources supported the cross-verification of findings. The use of a literature-informed conceptual framework ensured consistency in the identification and classification of approaches, while the integration of qualitative and quantitative techniques provided a transparent and systematic basis for analysis.

3.5. Methodological Limitations

Some limitations should be acknowledged.

First, the study is based on a single co-creation workshop, representing a specific point in time. Although participants were selected to reflect a range of stakeholder perspectives, the sample size limits the generalisability of the findings.

Second, familiarity levels are based on self-reported assessments, which are inherently subjective and may vary depending on participants' experience and confidence. As such, the results reflect perceived rather than objectively measured levels of knowledge or implementation.

Finally, the analysis focuses on the identification and perceived familiarity of CE approaches rather than their actual implementation or performance. The findings should therefore be interpreted as indicative of current awareness and understanding within the sector.

3.6. Ethical Considerations

The study adhered to the ethical guidelines of Maynooth University and received formal approval from the University's Research Ethics Committee prior to data collection. All participants were provided with an information sheet outlining the purpose of the research, the use of audio recordings, and data handling procedures. Written informed consent was obtained from all participants before their involvement in the workshop.

To ensure confidentiality, all data were anonymised during transcription and analysis. Audio recordings, notes, and visual materials were securely stored in accordance with institutional data protection policies and General Data Protection Regulation (GDPR) requirements.

This research was supported by funding from the Environmental Protection Agency (EPA), Ireland. The funding body had no role in the design of the study, data collection, analysis, interpretation of results, or the dissemination of the findings.

4. Results: Mapping Circular Economy Approaches in the Irish Construction Sector

The results are presented in two stages. First, the CE approaches identified by stakeholders are mapped across the construction lifecycle. Second, the distribution of these approaches across the workshop exercises is analysed to examine how stakeholders perceive their relevance within the sector.

4.1. Circular Economy Approaches Identified by Stakeholders

The first workshop activity explored CE approaches recognised by stakeholders in the Irish construction sector. Participants identified a wide range of strategies supporting circularity across the building lifecycle, which were organised according to key lifecycle stages: *design, construction, operation and maintenance, end-of-life,* and *cross-cutting approaches applicable across all stages* (see Table 1). Within each stage, approaches were further grouped into thematic categories reflecting specific domains of action.

At the design stage, stakeholders strongly emphasised the importance of embedding circularity early in project development. Within Design and Planning, key approaches included circular master planning, design for circularity (DfX/ecodesign), design for disassembly (DfD), and strategies focused on durability, longevity, and life extension. Modular construction (both 2D panelised and 3D volumetric) and prefabrication/off-site construction were also highlighted, alongside buildability and constructability considerations, reflecting a focus on efficiency and adaptability. Within Materials and Resources, stakeholders identified sustainable material sourcing, the use of recycled and secondary materials, material optimisation and resource efficiency, and the use of low-carbon, embodied carbon, and regenerative materials, indicating a strong emphasis on reducing environmental impacts from the outset.

At the construction stage, approaches focused on improving resource efficiency and reducing environmental impacts during project delivery. Within Construction and Waste, stakeholders highlighted construction and demolition waste (CDW) management and waste prevention, alongside the reduction of construction-phase embodied carbon emissions. In Systems and Processes, circular logistics for materials and circular procurement practices, including Green Public Procurement (GPP), were identified as key mechanisms to enable more efficient material flows and supply chain coordination. Additionally, embodied carbon considerations in material production were recognised within Materials and Resources, linking construction activities to upstream impacts.

The operation and maintenance stage centred on optimising building performance over time. Within the Energy category, stakeholders emphasised energy efficiency in operation and the rational use of

energy (RUE). In Systems and Processes, lifecycle material management was identified as a critical approach, highlighting the importance of monitoring, maintaining, and managing materials throughout the use phase to extend building lifespan and support future circular strategies.

At the end-of-life stage, stakeholders identified approaches aimed at enabling material recovery and recirculation. Within Construction and Waste, this included end-of-life management and deconstruction, material recovery processes, and pre-demolition audits to support informed decision-making. Complementary approaches included reverse logistics under Systems and Processes and material reuse and component reuse under Materials and Resources, reflecting the need for coordinated systems to retain material value beyond demolition.

Finally, a range of cross-cutting approaches applicable across all lifecycle stages were identified. Within Policy and Standards, stakeholders highlighted the importance of regulatory frameworks, material standards (including low-carbon standards), certification systems (e.g. ISO), and the certification of secondary materials. Under Assessment, whole life carbon assessment (WLCA) and lifecycle costing (LCC) were identified as key tools for evaluating environmental and economic performance. Digitalisation was recognised as a major enabler, including Building Information Modelling (BIM), digital data management, digital design optimisation, AI and IoT applications, material mapping systems, and material passports or digital product passports (DPP), all supporting data-driven decision-making and material traceability. In Systems and Processes, stakeholders identified circular business models (including Product-Service Systems, PSS), circular supply chain management, and broader systems approaches to circularity as essential for coordinating actions across the lifecycle.

Overall, the findings demonstrate that stakeholders perceive CE approaches as spanning the entire building lifecycle, combining stage-specific interventions with cross-cutting enablers. This reinforces the systemic and multi-dimensional nature of circularity in construction, requiring the integration of design strategies, material practices, operational processes, digital technologies, and supportive policy frameworks.

Table 1. Circular Economy Approaches Identified by Stakeholders.

Lifecycle Stage	***Category***	***Approach***
Design Stage	Materials & Resources	Sustainable Material Sourcing
	Materials & Resources	Use of Recycled / Secondary Materials
	Materials & Resources	Material Optimisation / Resource Efficiency
	Design & Planning	Modular Construction (2D panelised and 3D volumetric modular construction)
	Design & Planning	Circular Master Planning

	Design & Planning	Design for Disassembly (DfD)
	Design & Planning	Prefabrication / Off-site Construction
	Design & Planning	Buildability / Constructability
	Materials & Resources	Low embodied carbon materials/Regenerative Materials
	Design & Planning	Design for Circularity (DfX / Ecodesign)
	Design & Planning	Design for Durability and Longevity
	Design & Planning	Life Extension Strategies
Construction Stage	Construction & Waste	CDW Management / Waste Prevention
	Systems & Processes	Circular Logistics for materials
	Systems & Processes	Circular Procurement / GPP
	Construction & Waste	Construction Phase Embodied Carbon Emissions Reduction
	Materials & Resources	Embodied carbon material production
Operation & Maintenance Stage	Energy	Energy Efficiency in Operation
	Energy	Rational Use of Energy (RUE)
	Systems & Processes	Lifecycle Material Management
End-of-life Stage	Construction & Waste	Material Recovery
	Construction & Waste	End-of-life Management / Deconstruction
	Systems & Processes	Reverse Logistics / Transport
	Materials & Resources	Material Reuse / Components Reuse
	Construction & Waste	Pre-demolition Audits
Cross-cutting (All Lifecycle Stages)	Policy & Standards	Regulations / Policy Frameworks
	Policy & Standards	Standards & Certification Systems (e.g. ISO)
	Policy & Standards	Material Standards (Low-carbon)
	Assessment	Whole Life Carbon Assessment (WLCA)
	Digitalisation	BIM
	Systems & Processes	Circular Business Models / PSS
	Systems & Processes	Circular Supply Chain Management
	Assessment	Lifecycle Costing (LCC)
	Digitalisation	Digital Data Management
	Digitalisation	Digital Design Optimisation
	Digitalisation	Digital Technologies (AI, IoT)
	Digitalisation	Material Mapping Systems
	Digitalisation	Material Passports / DPP
	Policy & Standards	Certification of Secondary Materials
	Systems & Processes	Systems Approach to Circularity

4.2. Stakeholder Perceptions of Circular Economy Approaches

The analysis reveals a differentiated distribution of CE approaches across lifecycle stages, highlighting uneven levels of familiarity among stakeholders. Overall, familiarity is concentrated in material-

related practices, construction-stage activities, and regulatory frameworks, while operational, digital, and systemic approaches remain less embedded (see Table 2).

At the highest level of familiarity, approaches are relatively limited and primarily associated with established, practice-oriented interventions. In the design stage, stakeholders demonstrate strong familiarity with material-focused strategies, including sustainable material sourcing, the use of recycled and secondary materials, and material optimisation. Modular construction also stands out as a highly recognised design strategy, reflecting its growing uptake within the sector. In the construction stage, CDW management and waste prevention, as well as circular logistics for materials, are highly familiar, indicating their integration into existing workflows. At the end-of-life stage, material recovery is the only approach consistently identified at this level, reinforcing the continued emphasis on downstream value extraction. Cross-cutting familiarity is most evident in regulations, policy frameworks, and standards and certification systems, highlighting the influence of compliance-driven practices. Collectively, these approaches are characterised by their operational clarity, measurability, and alignment with established industry norms.

Approaches with a moderate level of familiarity are more diverse and span all lifecycle stages, reflecting areas of emerging but uneven implementation. In the design stage, stakeholders show awareness of strategies such as circular master planning, design for disassembly (DfD), prefabrication and off-site construction, buildability, and design for circularity (DfX/ecodesign). Low-embodied-carbon and regenerative materials also fall within this category, indicating growing attention to environmental performance beyond basic material efficiency. In the construction stage, construction-phase embodied carbon emissions reduction, circular procurement (including GPP), and embodied carbon in material production are moderately familiar, suggesting partial integration of decarbonisation considerations into project delivery. At the end-of-life stage, approaches such as deconstruction, pre-demolition audits, reverse logistics, and material reuse are recognised but not yet standardised, pointing to a gap between awareness and routine application. Cross-cutting approaches—including whole life carbon assessment (WLCA/LCA), low-carbon material standards, Building Information Modelling (BIM), and circular business models and supply chain management—are also moderately familiar. These findings indicate increasing engagement with process-oriented and enabling strategies, though their implementation remains inconsistent.

At the lowest level of familiarity, approaches are predominantly associated with long-term lifecycle thinking, operational performance, and advanced digitalisation. In the design stage, strategies such as design for durability and longevity and life extension are among the least familiar, despite their importance for extending building lifespans. The operation and maintenance stage is particularly underrepresented, with rational use of energy (RUE) and lifecycle material management both showing

low familiarity, and energy efficiency in operation only moderately recognised. Cross-cutting approaches in this category are dominated by digitalisation, including digital data management, digital design optimisation, AI and IoT applications, material mapping systems, and material passports or digital product passports. In addition, lifecycle costing (LCC), certification of secondary materials, and systems approaches to circularity also fall within this level, suggesting that these strategies remain largely conceptual rather than embedded in practice.

Overall, the findings point to a clear pattern: high familiarity is concentrated in established material practices, construction activities, and regulatory frameworks; moderate familiarity in design strategies, assessment tools, and emerging circular processes; and low familiarity in operational, digital, and systemic approaches. This distribution indicates that CE implementation in the Irish construction sector remains uneven, with significant gaps in integrating lifecycle thinking, strengthening operational practices, and scaling digital and system-level enablers of circularity.

Table 2. Stakeholder Knowledge with Circular Economy Approaches.

Lifecycle Stage	***Category***	***Level 1 – High Familiarity***	***Level 2 – Moderate Familiarity***	***Level 3 – Low Familiarity***
Design	Materials & Resources	Sustainable Material Sourcing; Use of Recycled / Secondary Materials; Material Optimisation / Resource Efficiency	Low Embodied Carbon Materials / Regenerative Materials	–
	Design & Planning	Modular Construction	Circular Master Planning; Design for Disassembly (DfD); Prefabrication / Off-site Construction; Buildability / Constructability; Design for Circularity (DfX / Ecodesign)	Design for Durability and Longevity; Life Extension Strategies
Construction	Construction & Waste	CDW Management / Waste Prevention	Construction Phase Embodied Carbon Emissions Reduction	–
	Systems & Processes	Circular Logistics for Materials	Circular Procurement / GPP	–
	Materials & Resources	–	Embodied Carbon Material Production	–

Operation & Maintenance	Energy	–	Energy Efficiency in Operation	Rational Use of Energy (RUE)
	Systems & Processes	–	–	Lifecycle Material Management
End-of-life	Construction & Waste	Material Recovery	End-of-life Management / Deconstruction; Pre-demolition Audits	–
	Systems & Processes	–	Reverse Logistics / Transport	–
	Materials & Resources	–	Material Reuse / Components Reuse	–
Cross-cutting (All Lifecycle Stages)	Policy & Standards	Regulations / Policy Frameworks; Standards & Certification Systems	Material Standards (Low-carbon)	Certification of Secondary Materials
	Assessment	–	Whole Life Carbon Assessment (WLCA)/Life Cycle Assessment (LCA)	Lifecycle Costing (LCC)
	Digitalisation	–	BIM	Digital Data Management; Digital Design Optimisation; Digital Technologies (AI, IoT); Material Mapping Systems; Material Passports / DPP
	Systems & Processes	–	Circular Business Models / PSS; Circular Supply Chain Management	Systems Approach to Circularity

5. Findings & Discussions

The findings of this study provide important insights into how CE approaches are currently understood and prioritised within the Irish construction sector. When interpreted in relation to the literature, the results suggest that while the range of CE strategies identified by stakeholders broadly reflects the conceptual expansion observed in academic research, their level of familiarity and perceived relevance remains uneven across lifecycle stages and types of approaches. This highlights a gap between the theoretical maturation of CE frameworks and their practical embedding within industry.

5.1. Persistence of a Material and Construction-Oriented Understanding of Circularity

One of the most consistent findings is the strong familiarity with material-related strategies and construction-stage practices, such as sustainable material sourcing, the use of recycled materials, CDW management, and circular logistics (for materials). This aligns closely with early CE research in construction, which was heavily focused on waste management and resource recovery at the end-of-life stage (Adams et al., 2017; Akhimien et al., 2021; López Ruiz et al., 2020).

Despite the conceptual shift in the literature toward lifecycle integration, the results suggest that this earlier paradigm continues to shape stakeholder perceptions. The prominence of material recovery as the only highly familiar end-of-life strategy further reinforces this interpretation, echoing findings that circularity in practice is often equated with recycling and waste diversion rather than systemic transformation (Giorgi et al., 2022). Circularity, therefore, remains strongly associated with tangible, operational activities, particularly those embedded within regulatory frameworks or established industry practices.

This pattern may also reflect the influence of policy and regulatory drivers in Ireland and the EU, where waste management targets and material recovery obligations have historically been more developed than lifecycle-oriented circular requirements. For example, the EU Waste Framework Directive (2008/98/EC) (European Parliament and Council of the European Union, 2008) establishes binding targets for the recovery of construction and demolition waste (CDW), requiring Member States to achieve at least 70% recovery by weight. This has been transposed into Irish policy through S.I. No. 126/2011 and the National Waste Management Plan for a Circular Economy (2024–2030), which place strong emphasis on CDW management, recycling, and material recovery practices. Similarly, Ireland's National Waste Management Plan for a Circular Economy (2024–2030) continues to prioritise waste prevention, reuse, and recycling targets, particularly in the construction sector.

In contrast, more recent EU initiatives, such as the proposed revision of the Construction Products Regulation (CPR), begin to introduce lifecycle-oriented requirements, including digital product

passports, material traceability, and whole-life performance considerations. However, these measures are still emerging and are less embedded in regulatory practice compared to established waste management obligations.

As a result, stakeholders' familiarity appears to mirror areas where compliance mechanisms and market structures are already in place.

5.2. Partial Uptake of Design-Based Circular Strategies

The literature clearly identifies the design stage as critical for enabling circular outcomes, with approaches such as design for disassembly, modular construction, and adaptability recognised as foundational strategies (Benachio et al., 2020; Charef & Lu, 2022; Eberhardt et al., 2022). The workshop results show that stakeholders are aware of many of these approaches, particularly modular construction, prefabrication, and DfD. However, most design-related strategies fall within the moderate familiarity category, and some, such as design for durability and life extension, remain among the least familiar.

This suggests a partial uptake of the design integration paradigm identified in the literature. While stakeholders recognise the importance of design, this recognition does not yet fully translate into widespread familiarity or implementation of more advanced or long-term strategies. In particular, the low familiarity with durability and life extension highlights a critical gap, given that these approaches are central to reducing lifecycle impacts and enabling circularity over time (Gamage et al., 2024; Nußholz, 2023).

At the same time, the relatively high familiarity with modular construction can be explained by recent policy and industry initiatives in Ireland. The government's Modern Methods of Construction (MMC) Action Plan explicitly promotes modular and off-site construction as a means to improve productivity and sustainability, while also addressing housing supply challenges. This policy direction is reinforced by its integration into the Housing for All strategy, where MMC is positioned as a key mechanism to accelerate housing delivery (Government of Ireland, 2021; Department of Housing, Local Government and Heritage & Department of Enterprise, Trade and Employment, 2023). In parallel, initiatives such as the Skillnet Ireland MMC Accelerate platform aim to support workforce development and skills uptake in this area (Skillnet Ireland, 2025).

This suggests that stakeholder familiarity is not only shaped by conceptual developments in the literature but also strongly influenced by national policy priorities and targeted capacity-building initiatives.

5.3. Limited Operationalisation of Lifecycle and Systemic Thinking

Recent research increasingly conceptualises CE as a lifecycle-wide and systemic framework, where strategies across different stages are interdependent (Eberhardt et al., 2022; Gamage et al., 2024). However, the results indicate that this systemic perspective is not yet strongly embedded in stakeholder understanding.

This is particularly evident in the operation and maintenance stage, which is notably underrepresented in terms of familiarity. Approaches such as lifecycle material management and rational use of energy are among the least familiar, despite their importance for extending building lifespan and optimising resource use over time. Even energy efficiency in operation, which is widely addressed in sustainability policies, is only moderately associated with CE practices by participants.

Similarly, cross-cutting systemic approaches, such as lifecycle costing and systems approaches to circularity, show low familiarity. This suggests that circularity is still largely perceived as a set of discrete interventions rather than an interconnected system of practices spanning the entire building lifecycle.

These findings contrast with the literature, which emphasises the interdependencies between design, construction, operation, and end-of-life strategies, and highlights the need for coordinated, multi-actor approaches across the value chain (Timm et al., 2023; AlJaber et al., 2025). The limited operationalisation of this systemic perspective represents a key barrier to achieving fully circular construction systems.

This gap between recognising individual circular strategies and operationalising a systemic, lifecycle-based approach is also reflected in Irish policy and industry discourse. The report Building a Circular Ireland: A Roadmap for a Resource Efficient Circular Built Environment (IGBC, 2025) highlights fragmentation across the construction value chain and identifies a lack of coordination between lifecycle stages, limited data sharing, and insufficient integration of circular principles into mainstream practices as key barriers. These findings reinforce the results of this study, suggesting that while circular strategies are increasingly recognised, their implementation remains fragmented and insufficiently aligned across the building lifecycle.

5.4. Digitalisation as an Emerging but Weakly Embedded Enabler

The literature identifies digital technologies,such as BIM, material passports, and data platforms, as critical enablers of circular construction, particularly in supporting traceability, lifecycle coordination, and data-driven decision-making (Benachio et al., 2020; Tserng et al., 2021; Lee et al., 2023). While stakeholders in this study recognise some of these tools, particularly BIM, most digital approaches are characterised by low familiarity.

Technologies such as digital data management, AI and IoT applications, material mapping systems, and digital product passports are among the least familiar approaches identified. This suggests that, although digitalisation is acknowledged conceptually, it has not yet been fully integrated into circular practices within the sector.

Recent industry evidence in Ireland provides further context for this pattern. The 2024 Build Digital Annual Survey indicates a continued increase in digital adoption across the construction and built environment sectors, with 81% of organisations actively engaging in digital transformation, up from 77% in 2023 (Build Digital Project, 2025). Key drivers of adoption include regulatory and policy instruments, particularly the Capital Works Management Framework (CWMF) BIM requirements (Irish BIM mandate), as well as demonstrated project-level benefits and demand from project partners (Build Digital Project, 2025).

However, despite this progress, the survey also highlights that digital transformation remains uneven and often focused on specific tools rather than fully integrated systems (Build Digital Project, 2025). While 60.5% of respondents of the survey report using digital tools to support sustainability objectives, this tends to involve applications such as BIM for circular processes, lifecycle assessment tools, and eco-design software, rather than more advanced circular enablers such as material passports or comprehensive material tracking systems (Build Digital Project, 2025). At the same time, the continued emphasis on training, guidance (e.g. BIM and SO 19650 documents), and industry events as key accelerators of digital adoption suggests that capacity building and knowledge development remain critical challenges.

Taken together, these findings suggest that digitalisation in the Irish construction sector is progressing but remains in a transitional phase. While adoption is increasing and supported by policy mandates and industry initiatives, the integration of digital technologies specifically to enable circular economy practices, particularly those requiring lifecycle data management and material traceability, remains limited. This helps explain the low familiarity with more advanced digital enablers of circularity identified in this study.

5.5. Alignment with Decarbonisation Agendas and Emerging Priorities

Recent research highlights a growing convergence between CE strategies and decarbonisation objectives, with increasing emphasis on prioritising approaches that deliver the greatest reductions in lifecycle carbon emissions (Iqbal et al., 2025; Nußholz, 2023). The workshop results show partial alignment with this trend.

Stakeholders demonstrate moderate familiarity with several carbon-related approaches, including construction-phase embodied carbon emissions reduction, low-carbon material standards, whole life carbon assessment (WLCA), and embodied carbon in material production. This suggests that

decarbonisation considerations are increasingly recognised within the sector, particularly in relation to design and construction decisions. However, this familiarity remains limited to a moderate level and does not yet reflect full integration across the building lifecycle.

This partial alignment is also reflected in Irish policy and industry discourse. The Irish Green Building Council (IGBC), in its report on Whole Life Carbon in Construction and the Built Environment in Ireland, highlights that while awareness of embodied and operational carbon is increasing, the consistent application of whole life carbon assessment across projects remains limited (O'Hegarty et al., 2022). The report emphasises the need to move beyond fragmented carbon reduction measures toward a lifecycle-based approach integrating design, material selection, construction processes, and end-of-life considerations.

These findings reinforce the results of this study. While key decarbonisation tools such as WLCA and low-carbon material standards are recognised, their application is not yet widespread, and carbon considerations across different lifecycle stages remain only partially embedded. This suggests that, although decarbonisation is becoming an important driver of change in the sector, its integration with circular economy principles is still at an emerging stage and has yet to be fully operationalised across the building lifecycle.

5.6. Implications for the Transition to Circular Construction

Taken together, the findings suggest that the Irish construction sector is at an intermediate stage in the transition toward circularity. Stakeholders are familiar with a broad range of CE approaches, reflecting the conceptual expansion documented in the literature. However, this familiarity is uneven and tends to be concentrated in areas that are already institutionalised, operationally tangible, or supported by existing regulations and policy initiatives.

In contrast, approaches that require long-term planning, systemic coordination, digital infrastructure, or lifecycle integration remain less embedded. This indicates that the transition to circular construction is not only a matter of identifying relevant strategies, but also of shifting how these strategies are prioritised, integrated, and operationalised across the sector.

Bridging this gap will likely require targeted interventions, including capacity building around design and lifecycle thinking, stronger integration of digital tools, alignment of policy frameworks with lifecycle approaches, and the development of market and organisational mechanisms that support circular practices across the value chain.

6. Conclusions

This study identifies CE approaches in the Irish construction sector and examines how these approaches are understood and positioned by stakeholders across the building lifecycle. By combining a literature-informed framework with empirical insights from a multi-stakeholder workshop, the research provides both a structured mapping of CE approaches and an assessment of their perceived familiarity in practice.

The findings show that stakeholders recognise a broad range of CE approaches spanning all lifecycle stages, reflecting the conceptual expansion highlighted in the literature. However, this range of approaches identified is not matched by an equivalent depth of familiarity. Instead, familiarity is unevenly distributed across approaches and lifecycle stages.

High familiarity is concentrated in material-related strategies, construction-stage practices, and regulatory frameworks. These approaches, such as sustainable material sourcing, recycled materials, CDW management, and policy instruments, are well established, operationally tangible, and often driven by existing compliance requirements. In contrast, approaches related to lifecycle thinking, operational performance, digitalisation, and systemic coordination remain less familiar and less embedded in practice.

The results also point to a partial uptake of design-based circular strategies. While stakeholders demonstrate awareness of key approaches such as modular construction, prefabrication, and design for disassembly, more long-term strategies, particularly design for durability, adaptability, and life extension, remain less familiar. This highlights a gap between the recognised importance of design in enabling circularity and its full integration into practice.

More broadly, the findings indicate a limited operationalisation of lifecycle and systemic thinking. The operation and maintenance stage is notably underrepresented, and cross-cutting approaches such as lifecycle costing, systems approaches to circularity, and integrated supply chain strategies show low familiarity. This suggests that circularity is still largely perceived as a set of discrete actions rather than an interconnected system spanning the entire building lifecycle.

Digitalisation emerges as a recognised but weakly embedded enabler. While BIM shows moderate familiarity, more advanced digital approaches, such as material passports, digital data management, and AI-enabled systems, remain at a low level of familiarity. This indicates that the digital infrastructures required to support circular construction, particularly those enabling material traceability and lifecycle coordination, are still in an early stage of adoption.

In relation to decarbonisation, the findings reveal an emerging but incomplete alignment between CE strategies and climate objectives. Stakeholders demonstrate moderate familiarity with key carbon-related approaches, including whole life carbon assessment, low-carbon material standards, and

embodied carbon reduction strategies. However, these approaches are not yet fully integrated across lifecycle stages, suggesting that the convergence between circularity and decarbonisation remains at an early stage in practice.

Overall, the study suggests that the Irish construction sector is at an intermediate stage in the transition toward circularity. While there is clear awareness of a wide range of CE approaches, their implementation remains uneven and concentrated in areas supported by existing practices and policy frameworks.

Advancing this transition will require moving beyond the identification of individual approaches toward their systematic integration across the building lifecycle. This includes strengthening capacity in design for circularity, embedding lifecycle and operational practices, expanding the use of digital tools for material traceability, and aligning policy frameworks with both circular economy and decarbonisation objectives. Greater coordination across stakeholders and supply chains will also be essential to support the shift from fragmented interventions to fully integrated circular construction systems.

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