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Circular Transition in the Built Environment: Business Model Readiness and the Pathways to Collaboration

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Abstract

The Swiss construction sector, responsible for over 80% of the country's total waste generation and a third of national CO₂ emissions, faces growing pressure to transition toward a circular economy (CE). Despite increasing awareness, the sector remains characterized by fragmented initiatives and limited systemic adoption. This study investigates how key industry actors (architects, construction companies and associations) interpret, implement and enable CE principles within Switzerland's built environment. Combining an extensive literature review with fifteen semi-structured expert interviews, the research analyses both conceptual understanding and practical application of circular strategies across stakeholder groups. The findings reveal that while technological and design-oriented innovations are emerging, financial and organizational structures remain predominantly linear, constraining large scale implementation. To address this gap, the study introduces the Circular Economy Business Model Canvas (CEMBC), an adapted analytical framework that translates circular principles into nine interrelated business model dimensions. Applied empirically, the CEMBC exposes key asymmetries: architects exhibit high conceptual engagement yet limited financial

integration; construction companies show practical experimentation but weak systemic coherence; and associations act as facilitators, though constrained by cultural and economic inertia. The results highlight three critical levers for progress necessary to overcome current barriers: ecosystem collaboration, lifecycle cost accounting and the creation of new circular revenue streams. Ultimately, this research contributes to both academic and professional disclosure by providing a structured methodology for assessing circular maturity and by positioning business model transformation as a prerequisite for a viable and scalable circular transition in the construction sector.

Keywords: *Circular economy, Swiss construction sector, Business model transformation, Business Model Canvas, Circular value creation, Ecosystem collaboration, Circular maturity assessment*

List Abbreviations

Business Model Canvas	BMC
Circular Business Model	CBM
Circular Economy	CE
Circular Economy Business Model Canvas	CEBMC
International Accounting Standards	IAS
Swiss Society of Engineers and Architects	SIA

1. Introduction

The Swiss construction sector consumes nearly 63 million tons of materials annually and produces approximately 17 million tons of waste, representing an astonishing 84% of the country's total waste (SIA, 2024, p. 1). Despite growing environmental awareness and technical innovation, less than 7% of these materials are reused or reintegrated into the economy after deconstruction (Circle Economy, 2023, p. 9). Moreover, one third of the CO₂ emissions in Switzerland derive from the construction sector. These figures highlight the urgency of rethinking how buildings are designed, constructed, and dismantled. While most

sustainability discussions in the built environment have traditionally focused on energy efficiency and carbon emissions, the Circular Economy (CE), with its emphasis on reuse, material loops, modularity, and longevity, offers a complementary and increasingly essential approach to reduce environmental burden and increase material productivity. (Switzerland Innovation Park Central, 2023)

Over the past decade, a growing number of construction actors have begun to explore CE principles (Jegen, Gast, & Faulstich, 2025). Industry reports, online documentation, and internal case studies from construction firms, associations, and architects highlight a range of experimental and pilot projects, such as the K.118 project in Winterthur (Zirkular, 2021) or the Novu Campus (S. Dumelin, personal communication, June 23, 2025). These include techniques such as deconstruction, on-site reuse, modular components, and even digital tracking of materials (Byers, Raghu, Olumo, De Wolf, & Haas, 2024). The industry appears to be in a phase of innovation and diversification, where various approaches are tested, refined, and promoted (Pomponi & Moncaster, 2017). However, most of this development has remained either operational or design-focused, as will be shown in the following chapter. There is a notable lack of literature and practice-based analysis regarding the financial implications of circularity in the construction industry, particularly regarding how business models, cost structures, and value retention mechanisms are affected or could be affected by CE practices.

This paper aims to fill part of this gap between circular construction initiatives and financial implications by providing a grounded understanding of how circularity is currently interpreted and implemented across key construction industry actors in Switzerland. The study seeks to map out the actual state of the field and to evaluate the systemic readiness of the construction ecosystem for circularity. In particular, the study focuses on three central groups of actors: architectural firms, construction companies, and industry associations, each of which plays a distinct yet interconnected role in enabling or limiting circular practices.

The research combines existing evidence from prior literature and digital sources with empirical insights gathered through a series of qualitative interviews. These interviews were tailored to the specific perspectives of each actor group and were designed to elicit how CE concepts are operationalized in daily practice. Due to the level of confidentiality agreed and signed with the interviewees, full transcripts of the interviews are not publicly available. The results are then mapped into the Business Model Canvas (Osterwalder & Pigneur, 2010, p. 44) suggesting the Circular Economy Business Model Canvas (CEBMC). Building on the

foundations of the classical Business Model Canvas, the CEBMC redefines the nine dimensions through a circular lens, making it possible to assess not only how circular strategies are currently reflected in operations, value propositions, cost structures, and customer relationships, but also where systemic gaps and opportunities for innovation lie. While this paper does not evaluate the financial outcomes of CE strategies directly, it builds a necessary foundation for future work by clarifying what is currently being done, by whom, and under what conditions. Therewith, the study points at potential financial benefits, which shall be evaluated in future research.

By identifying not only emerging practices but also strategic tensions and blind spots, this work contributes to both academic literature as well as industry reflection. It highlights the importance of aligning technical innovation with financial feasibility, while also offering a comparative model for analysing the maturity of circularity across different types of construction actors.

The paper is structured into six parts. Following the introduction, the second chapter provides the theoretical background on circular economy and the Swiss construction industry. The third chapter introduces the research methodology, followed by chapter four with the data analysis. Chapter five concludes the theoretical background and empirical findings into the results, lastly followed by the conclusion including recommendations for future research in chapter six.

2. Literature Review

2.1 The Current Status of the Swiss Market

2.1.1 Development Over the Past Years

Sustainability has become one of the defining challenges of our time. The construction sector, responsible for significant resource consumption and waste generation, is under increasing scrutiny. In Switzerland, this industry not only dominates material use but also contributes heavily to the national carbon footprint. In fact, the Circularity Gap Report¹ highlights that construction, alongside manufacturing and agri-food, ranks among the top three sectors for

¹ The Circularity Gap Report Switzerland (2023) is a national-level study developed by Circle Economy in collaboration with Swiss partners, assessing material flows, circularity performance, and opportunities to accelerate the transition towards a circular economy.

both material and carbon impact (Circle Economy, 2023, p. 9). These data underscore construction's central role in any environmental transition strategy.

Over the past decade, the concept of CE has evolved from an abstract idea to a field of practical application and increasing exploration. CE is commonly defined through so called R-strategy, notably the 5R framework: refuse, reduce, reuse, recycle, and recover, which structures strategies to minimize resource use and waste (Reike, Vermeulen, & Witjes, 2018, p. 253). Closely linked to this framework is the cradle-to-cradle concept, which emphasizes designing products and processes in closed loops where waste becomes input for new cycles (von der Lancken, 2023), a model that we will revisit in Chapter 4. Yet, despite mainstream recognition, widespread implementation remains limited. In Switzerland, less than 7% of construction materials are currently recycled or reused post-deconstruction (Circle Economy, 2023, p. 9). This figure reflects a broader national pattern: about 93% of materials consumed originate from virgin sources, leading to a circularity rate lower than the global average and far below sustainable thresholds (Circle Economy, 2023, p. 9). Compounding this issue, Switzerland's per-capita material footprint stands at 19 tonnes annually, more than double the sustainable level of around 8 tonnes (Circle Economy, 2023, p. 9).

A striking challenge is the country's dependence on concrete, the second most used material worldwide, which significantly contributes to environmental degradation and resource depletion (Williams, 2024). At the same time, the Global Footprint Network warns that global resource consumption exceeds planetary boundaries by a factor of 1.8 (Wackernagel et al., 2025). Additionally, even non-traditional materials such as sand face depletion risks within decades due to construction demand (Evans, 2024). Together, these growing challenges emphasize that the construction sector must accelerate systemic change if Switzerland is to maintain its resource integrity.

2.1.2 Sector-Specific Developments in Switzerland

Construction's environmental challenges have triggered a range of new initiatives at multiple levels. The Swiss Society of Engineers and Architects (SIA) has advanced policy and technical instruments to embed CE principles within the sector, promoting standards that emphasize material reuse and modular design (SIA, n.d.). Digital tools and guidelines, such as those published by SIA on circular building practices, have begun helping professionals incorporate dismantling, lifecycle planning, and resource tracking early in design processes (SIA, n.d.).

Within this evolving landscape, three main stakeholder groups play a central role in advancing circularity across the construction value chain. **Architects** act as early-stage enablers, embedding circular design principles and modularity into planning and material selection, and continuously adapting project plans based on available materials throughout the construction process (WRS Region Stuttgart GmbH, n.d., p. 23). **Construction companies** operate as implementers, translating design intent into practical applications through recycling technologies, modular systems, and reverse logistics (WRS Region Stuttgart GmbH, n.d., pp. 44-45). **Associations** serve as ecosystem facilitators, developing standards, fostering collaborations and promoting regulatory alignment to scale CE practices at the industry level (C33, n.d.).

In line with the 5R framework discussed in Chapter 2.1.1 (Refuse, Reduce, Reuse, Recycle, Recover) the following analysis maps how selected Swiss market actors contribute to different stages of the circular hierarchy in construction. Figure 1 illustrates the areas of influence for representative organizations across architecture, construction, and industry associations. A brief description of each organization, including its main activities and the specific “R” on which it primarily focuses, is provided in Appendix A.

The mapping shows that architectural firms, such as Modulart and Zirkular, play a central role in the Refuse and Reduce dimensions by integrating modularity, reversibility, and resource minimization into their design philosophies (Modulart, n.d.; Zirkular, n.d.). Digital platform providers like Madaster primarily enable Reuse, supporting material traceability and facilitating future disassembly through building material passports (Madaster, n.d.). Construction companies, including Kibeco and Foldcast, have a tangible impact on Reuse and Recycle, developing modular concrete systems and recycled construction materials (KIBAG, n.d.; Foldcast Sagl, n.d.). Firms such as Schwörer additionally contribute to Refuse, reducing the need for new material extraction through closed-loop production processes (SchwörerHaus, n.d.). Finally, associations such as C33 and Cirkla act as ecosystem facilitators: C33 promotes Refuse, Reduce, and Reuse through advocacy and awareness programs, while Cirkla focuses on Reuse, coordinating networks for the redistribution and reemployment of building components (C33, n.d.; Cirkla, n.d.).

	Architects			Construction companies			Associations	
	Modulart	Zirkular	Madaster	Kibeco	Foldcast	Schwörer	C33	Cirkla
Refuse								

Reduce								
Reuse								
Recycle								
Recover								

Table 1: Contribution of different players in the Swiss construction industry to the 5 R's (own illustration)

Overall, this mapping reveals that Swiss actors contribute to circularity at different levels of the 5R hierarchy, with most initiatives concentrated in the middle stages: Reuse and Recycle. Early-stage actions such as Refuse and Reduce, which require systemic design and procurement shifts, remain less widespread. This imbalance highlights the need for deeper collaboration between design, production, and regulatory stakeholders to extend circularity across the full value chain.

2.1.3 Emerging Drivers of Circular Interest

While the chapter above describes a rather early state of circularity progress for the construction industry in Switzerland, there are several factors accelerating the industry's interest in circularity. The three main explanations for this recent acceleration are:

- 1. Strategic Innovation & Resource Resilience:** CE offers firms new business models, including reuse-based value chains, that can mitigate supply volatility and create economic differentiation (McKinsey et al., 2025).
- 2. Regulatory Momentum:** A parliamentary initiative integrated into Switzerland's Environmental Protection Act (2024) promotes resource conservation and incentivizes CE in different sectors, including construction. Canton Zurich has also enshrined CE principles in its constitution, demonstrating growing regional policy commitment (Swiss Federal Office for the Environment, 2025; Circle Economy, 2023, p. 54).
- 3. Scarcity Awareness:** Awareness of resource depletion—especially for materials like sand and concrete—has shifted stakeholder attention toward sustainable alternatives (Evans, 2024; Williams, 2024).

Overall, these developments suggest that circularity in Switzerland's construction sector is gradually gaining relevance, driven by innovation opportunities, evolving regulation, and growing awareness of resource constraints. While the scope and effectiveness of these measures remain to be seen, they illustrate a shift in attention that goes beyond abstract debate.

2.2 The Need for Circular Business Models

The growing importance of sustainability in the construction sector calls for a fundamental rethinking of how value is created, delivered, and captured. Traditional business models, largely based on linear flows of materials and revenue (Takacs, Stechow, Frankenberger, 2020), are inadequate for addressing the complex, long-term challenges of resource depletion, environmental degradation, and system-level inefficiencies.

Circular business models differ fundamentally from linear ones in that they prioritize longevity, circular flows, material cycles and systemic value over short-term gains. Instead of a “take-make-dispose” approach, CBMs encourage reuse, remanufacturing, and service-based offerings that decouple growth from resource consumption. In the context of construction, this implies designing buildings for disassembly, selecting recyclable materials, and creating new ownership and service structures such as leasing or modularity (Lüdeke-Freund, 2018).

The Business Model Canvas² (BMC), developed by Osterwalder and Pigneur (2010), is widely used as a tool for visualizing and analysing business models. However, it was designed for linear systems and lacks dimensions necessary to reflect the regenerative, interdependent, and dynamic aspects of circularity. Therefore, to assess the maturity of circular practices in the Swiss construction industry, we developed an adapted version: the Circular Economy Business Model Canvas (CEBMC).

2.2.1 Designing the Circular Economy Business Model Canvas (CEBMC)

In order to move from critique to application, it is essential to propose a framework capable of reflecting the complex interrelations inherent to circular business models. The following section presents the design of the Circular Economy Business Model Canvas (CEBMC), developed to meet this objective.

The CEBMC serves the same purpose and uses the same 9 dimensions approach as the BMC. However, it helps companies to consider each of the dimension from a circular perspective, which ultimately helps integrating the fragmented contributions of actors (see Figure 1) to an integrated overall project approach in the Swiss construction industry. The list below uses the theory above and links key theoretical concepts of circular economy to the 9 dimensions of the BMC and the CEBMC:

² Through the Cava business model, Osterwalder and Pigneur (2010) offer a visualisation and definition of nine components of business models. This provides an intuitive understanding of how a company and its business model work.

- Circular Partners – Strategic partnerships that enable reverse logistics, material reuse, and shared infrastructure (e.g., Deconstruction firms, Municipalities, or housing cooperative).
- Circular Activities – Core operations like circular design, modular build selective deconstruction, and traceability systems.
- Circular Value Proposition – Offerings centred on durability, reparability, and long-term performance.
- Sustainable Customer Relations – Engagement models based on long-term service, co-design, and lifecycle commitment.
- Durable & Traceable Channels – Physical and digital platforms enabling transparency and material tracking (e.g., Open-source material inventories, or Digital building passports).
- Circular Ecosystem – The broader network of actors supporting CE practices (e.g., municipalities, suppliers, or clients).
- Cost Structure – Accounting for lifecycle costs and material residual value.
- Circular Revenue Models – Income streams such as product-as-a-service, resale, and material recovery.
- Sustainable Resources – Use of recycled, renewable, or easily dismantlable components.

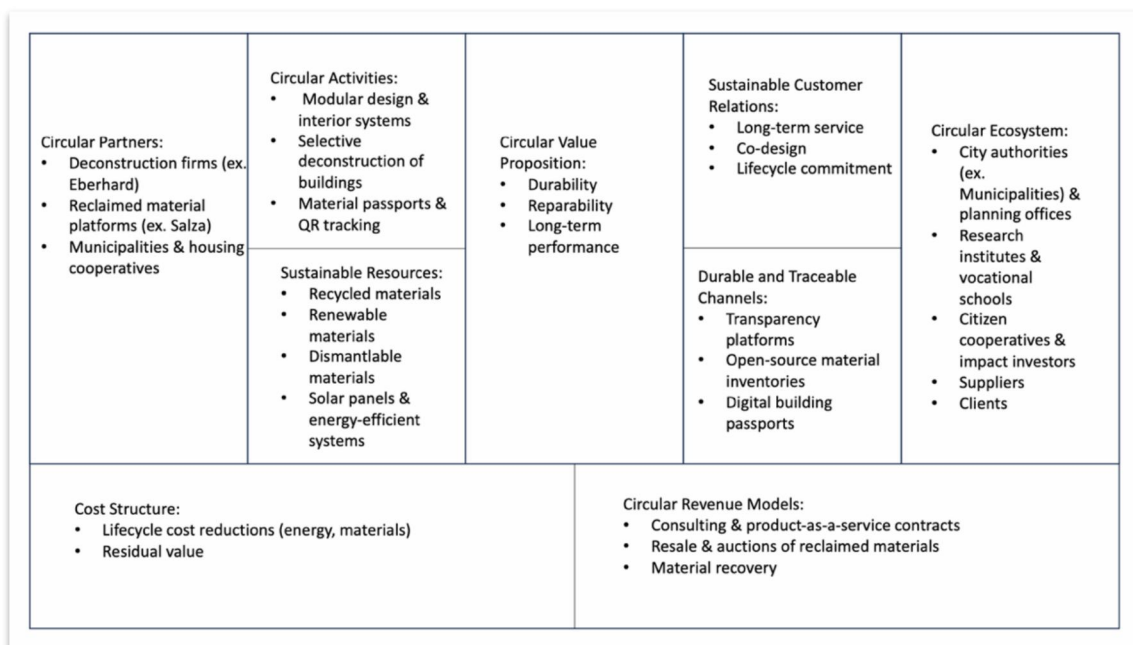


Figure 1: Circular Economy Business Model Canvas (Own illustration based on Osterwalder & Pigneur, 2010. P.44)

The findings above lead to the conclusions that first circular economy initiatives in the Swiss construction industry are currently rather fragmented instead of integrated, secondly that different players may only contribute to a limited part of an overall circularity definition and circularity approach, and thirdly that businesses most likely need to integrate circularity in all dimensions of their planning (e.g. in all 9 dimensions of the CEBMC). Therewith, the subsequent chapters will address the following questions: to what extent are architects, construction companies and associations in Switzerland prepared to integrate circular economy principles into their business models, and therewith transition from the current rather single-point oriented practices to an integrated, comprehensive circularity approach. And secondly, how can standardised frameworks and partnerships support this transition.

3. Methodology

Based on the theoretical findings from chapter 2, the study adopts a qualitative, multi-step methodology aimed at understanding CE practices in the construction sector and subsequently to answer the questions concluding chapter 2.

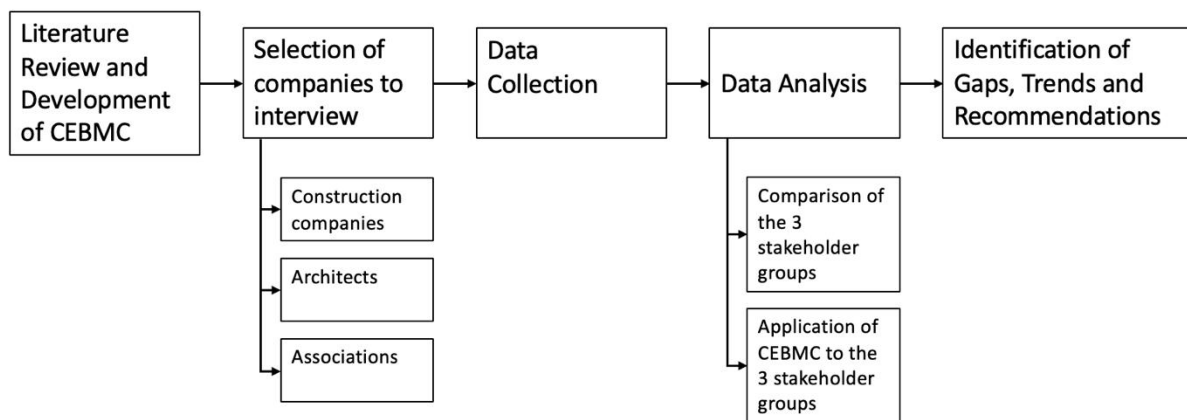


Figure 2: Overview of study methodology (own illustration)

The research process is illustrated in Figure 1. It follows a sequential and iterative structure beginning with a literature review, which established the theoretical foundation on CE in construction and informed the development of the CEBMC. This was followed by the selection of interview partners across three key stakeholder groups – architects, construction companies, and associations - chosen for their influence across the building lifecycle. The data collection phase consisted of semi-structured interviews tailored to each group’s role in CE implementation. Subsequently, data analysis compared the responses of the three stakeholder groups and applied the CEBMC framework to their practices. The final stage

focused on the identification of gaps, trends and recommendations to support the integration of circular principles into business models and industry practice.

3.1 Prior Research and Framing

The first step of the research involved an extensive review of existing literature and publicly available information to develop a foundational understanding of CE in the context of construction. Academic publications were complemented by reports and data drawn from the websites of recognized organizations and professional associations, most notably the Swiss Society of Engineers and Architects (SIA).

This initial phase served two main purposes. First, it aimed to build a shared conceptual framework among the research team regarding the principles and design strategies underpinning circular construction. Second, it helped clarify the current regulatory and industrial context, identifying where knowledge gaps and inconsistencies persist between theory and practice.

Based on insights from this review, a qualitative research design was developed to explore these gaps through expert interviews. In total, 15 semi-structured interviews were conducted with representatives from key stakeholder groups. The interviews were conceived as a second methodological step, allowing for a deeper examination of how CE concepts are interpreted, operationalized, and challenged in practice.

In this sense, the interviews build directly on the literature review: while the latter established the conceptual and policy background, the empirical phase aims to assess how these ideas are being implemented by key actors in the Swiss construction ecosystem. The following section outlines the selection criteria for interview partners and the data collection process.

3.2 Stakeholder Identification and Selection

Following the desk research, we conducted a stakeholder mapping to identify relevant actors in the Swiss construction ecosystem who are engaged with or affected by CE transitions. The aim was to ensure a balanced and interdisciplinary set of perspectives, capable of addressing both design-level and systemic considerations, including cost dynamics and regulatory frames.

The diverse range of actors selected enabled a multi-level understanding of circularity. The stakeholder groups were categorized into three main groups: architects (A), construction companies (C), and professional associations (S). These groups were chosen because they represent the actors with the strongest influence across the building lifecycle, shaping both the

design and material decisions as well as the regulatory and strategic frameworks within which circular practices evolve.

In total, 15 organizations were interviewed: 5 architectural firms, 8 construction companies, and 2 professional associations. A detailed description of the interviewed organizations, along with their categorization, is provided in Appendix B.

3.3 Interviews and Thematic Focus

The 15 interviews were conducted using semi-structured formats, with a common core but tailored to the specific roles of each interviewee. Three dedicated questionnaires were developed to guide the conversations:

- One for architects, focused on design strategies, material choices, and project challenges;
- One for construction and demolition companies, addressing practical implementation, reuse testing, and production innovation;
- One for associations and institutional actors, focused on standard-setting, education, and system-level coordination.

These questionnaires are provided in Appendix C (for architects), Appendix D (for construction companies), and Appendix E (for associations) for reference and transparency.

The interviews focused on five parts that had emerged as particularly relevant, yet only partially addressed in the preliminary review of existing literature. First, they investigated the current state of circular construction practices in Switzerland, mapping the degree of implementation and experimentation already underway. Second, they examined the economic, regulatory, and material challenges that continue to constrain wider adoption. Third, attention was given to both the perceived and actual financial impacts of CE strategies. Building on insights from the literature, which highlighted a lack of business model integration in circular construction, additional questions were included to explore how companies envision or implement new business models. These findings later provided the empirical foundation for the analysis based on the CEBMC. Fourth, the discussions addressed the role of financial accounting mechanisms and how these could enable circular business models by capturing long-term value. Finally, the interviews sought to identify emerging best practices as well as policy recommendations that could support the scaling of circularity in the construction sector.

As the stakeholder groups have different roles and responsibilities in a construction project, as well as a varying influence onto circularity of a construction project, each interview includes both general questions (which were addressed with every stakeholder groups), as well as stakeholder group specific questions. The general questions concerned around the following six core dimensions of CE orientation:

1. CE Definition
2. Adoption Start
3. Advantage/Opportunity
4. Constraints/Cost
5. Collaborations
6. Enablers/Drivers

The 15 semi-structured interviews were conducted between March and June 2025 (see Appendix B).

3.4 Analysis of the Interviews

All interviews were qualitatively analysed and systematically compared for each question, by stakeholder groups in order to comprehend the difference in the respective questionnaires. This narrative analysis focused on identifying both average trends as well as outlier responses, and therewith capturing not only the frequency of specific themes but also their depth and orientation. The respective tales can be found in Appendix F to H, each appendix for one stakeholder group.

Based on this detailed analysis, a summary was compiled for the questions concerning the core dimensions of CE orientation, i.e. for the questions which were shared by all three stakeholder groups and which were therefore asked similarly in all interviews (see table 1).

This summary also includes a score from 1 to 3 indicating the average engagement of the stakeholder group for the respective core dimension of CE orientation (1 = low engagement, 2 = moderate engagement, 3 = high engagement). These scores were then further summarized into a heatmap summarizing similarities and differences between stakeholder groups and dimensions of CE orientation (see table 2).

Finally, the findings derived from the interview analysis were systematically compared with insights from the literature review, allowing for a critical reflection on how practice aligns

with, diverges from, or extends to current theoretical and empirical knowledge on CE in the construction sector.

4. Data Analysis

This chapter presents the qualitative analysis of the interview data, structured into two parts. The first section examines each stakeholder group - architects, construction companies, and associations - individually, reflecting the fact that interviews explored different topics in varying depth depending on each stakeholder group's role in the circular construction ecosystem. The second section offers a comparative analysis across stakeholder groups, focusing on the six core dimensions of CE orientation (as shown in Table 1), to highlight similarities and divergences between the stakeholder groups regarding their CE orientation. This structure not only allows detailed understanding of the specificities of each stakeholder group, but also to discuss systemic patterns to be observed across the construction industry.

4.1 Stakeholder Perspectives on Circular Economy Implementation

We now turn to an in-depth analysis of the interview responses, examining each stakeholder group individually to better understand how architects, construction companies, and professional associations interpret and apply CE principles within the built environment. This section aims at identifying recurring patterns, internal tensions, as well as sector-specific challenges and innovations that shape each stakeholder group's engagement with circular construction.

Architects (Appendix F)

Architectural respondents provided an ideational and systems-oriented interpretation of the CE. Most defined CE through the lenses of material stewardship, longevity, and design-for-reuse. The majority emphasized the importance of keeping materials at their highest value, with recurrent references to cradle-to-cradle principles and regenerative design. Their responses suggest a strong theoretical alignment with CE, though practical implementation varies significantly across firms and projects.

When discussing the operationalization of material circularity, many architects stressed the critical role of early-phase design decisions. Several highlighted the use of Building Information Modeling (BIM) and material databases to improve traceability and manage resources throughout the building lifecycle. However, challenges were noted, primarily the

absence of centralized, reliable data on material provenance and the lack of interoperable digital platforms that support reuse planning. This fragmentation of tools and standards was described as a major limitation for both collaboration and impact assessment.

On the topic of business models, most architects acknowledged their constrained influence, often dictated by client priorities and regulatory boundaries. While some referenced design-for-disassembly and modularity, only a few mentioned applying new revenue models or extended service offerings. Nonetheless, a minority envisioned a more strategic role for architects, acting as sustainability consultants who guide clients through circular decision-making. Though not yet mainstream, this perspective signals a growing ambition within the profession to expand its impact beyond traditional design roles.

Regarding the meaningful use of materials, architects offered particularly reflective perspectives. Material selection was framed not only as a technical decision, but also as an ethical and cultural one, connecting to themes of architectural identity and contextual integrity. However, many noted the persistent tension between reuse and aesthetic or functional expectations, underlining that CE in architecture requires navigating symbolic as well as performance-based considerations.

Collaboration was universally seen as indispensable, yet often hindered by fragmented project structures and misaligned incentives. Architects expressed frustration at procurement systems that reward short-term cost savings over lifecycle value, making circular design a difficult proposition in competitive bidding contexts. In addition, interviewees highlighted the lack of trusted, sector-wide platforms that facilitate interdisciplinary coordination, data sharing, or matchmaking for reused materials. This infrastructural gap was seen as a key barrier to systemic adoption.

Finally, in terms of standards, architects reported a widespread absence of shared labels or certifications to evaluate or communicate circular performance. While some mentioned efforts like material passports or pilot frameworks under development, there was consensus that the industry lacks authoritative, comparable metrics. Without this foundation, CE remains difficult to validate, replicate, or justify economically.

Construction Companies (Appendix G)

The responses from construction companies reflect a pragmatic yet uneven engagement with CE principles. On the definitional level, most companies emphasized the importance of minimizing waste, reducing the input of virgin materials, and keeping products and resources

within the economic loop. This operational framing of CE was relatively consistent. However, a few companies articulated more expansive views, including notions of systemic change, such as shifting away from linear thinking or rethinking entire value chains, highlighting a growing awareness of CE as a strategic transformation rather than a set of technical measures.

When asked about keeping materials in the loop, many interviewees acknowledged existing efforts in selective demolition, recycling, and the reuse of components. Yet there was notable variation in the scale and maturity of these practices. Some firms reported well-established internal systems, while others appeared to be in exploratory or pilot phases. Interestingly, one outlier company suggested that keeping materials in the loop is only feasible for select material streams, challenging the assumption of universal applicability.

In terms of business model innovation, the majority of companies struggled to articulate clear changes or expressed uncertainty. Few referenced service-based models, material leasing, or design-for-deconstruction approaches, elements often seen as central to CE. This reveals a gap between technical implementation and deeper structural change. Those that did mention new models tended to be startups or smaller firms with more agile organizational structures, suggesting that incumbents may face greater barriers to transformation.

Regarding the meaningful use of materials, responses coalesced around material efficiency and sourcing practices. Some emphasized digital tracking tools and material passports, while others pointed to low-carbon alternatives. One particularly surprising input came from a firm arguing that the focus should shift from materials to spatial efficiency and demand reduction—broadening the scope of sustainability beyond CE’s usual material-centric discourse.

When discussing collaboration, almost all companies recognized the critical importance of working across the value chain. However, several cited systemic obstacles: lack of standardized frameworks, fragmented project delivery models, and limited client awareness. These insights affirm a central finding - construction companies, while technically engaged, cannot drive the transition to a circular economy in isolation. A more integrated ecosystem involving architects, clients, and regulators is essential.

In addition, when asked about circularity-related KPIs, companies confirmed that few shared indicators exist across the industry. Most firms rely on self-developed internal indicators, if any. The most frequently mentioned metric is the recycled content of concrete, but broader metrics (e.g., reused material volume, circular value) are either missing or inconsistently

applied. Similarly, labels and certifications remain limited. While some companies are familiar with early-stage systems or emerging schemes (such as Minergie-ECO), they noted that no widely recognized and sector-specific framework is currently available to validate circular performance at scale.

Strategic tensions emerged as a recurring theme. Companies acknowledged internal misalignments between sustainability goals and cost optimization pressures. Some departments are actively working toward circular solutions, while others remain risk-averse or narrowly focused on traditional delivery models. This reveals a lack of internal coordination, as well as a gap between long-term innovation narratives and short-term project realities.

Finally, the financial dimension remains underdeveloped. While some respondents alluded to potential cost savings in material sourcing or waste management, most noted that financial evaluation models are not yet adapted to capture the long-term value of CE. Depreciation and residual value strategies, for instance, were largely unfamiliar or underutilized, pointing to a need for stronger alignment between technical innovations and financial reporting systems.

Associations (Appendix H)

Associations approached the circular economy primarily from a macro and governance-oriented perspective, positioning themselves as facilitators rather than direct implementers. Their definitions of CE consistently referred to systemic frameworks, such as the 5Rs (Refuse, Reduce, Reuse, Recycle and Recover), and emphasized the need for long-term thinking and closed-loop resource management (Reike, Vermeulen, & Witjes, 2018, p. 253). They view circularity not merely as a technical adaptation, but as a structural shift requiring cultural, regulatory, and operational alignment across the construction ecosystem.

When reflecting on the Swiss construction industry's current level of commitment, associations described the overall progress as slow but positive. Some framed it as "gradual but evolving," acknowledging that awareness has increased over the past decade, yet that real implementation remains limited to a small group of pioneering actors. From their vantage point, the main bottlenecks are economic incentives, regulatory gaps, and inertia within traditional procurement and development models. Still, they noted a marked increase in pilot projects and public discourse, especially among younger professionals and municipalities.

Regarding their own role, associations see themselves as ecosystem enablers with a mandate to inform, coordinate, and influence. Although they do not typically initiate building projects themselves, they engage in standard-setting, training, and the creation of practical tools for the

industry. For instance, they contribute to the development of CE guidelines, lifecycle-based certification schemes, and policy recommendations aimed at embedding circularity into technical norms. Some associations also participate in working groups with public authorities to push for regulatory evolution. One respondent emphasized their role in “connecting the dots” between academia, construction firms, and policymakers, a form of strategic orchestration rather than execution.

Internal CE initiatives are generally tied to these coordinating activities. Associations organize workshops, publish manuals and methodological handbooks, and promote knowledge-sharing events across stakeholder groups. While not operational in the traditional sense, these initiatives create foundational infrastructure for broader circular adoption.

In terms of innovation, associations often function as observers and amplifiers. They cited several examples of promising circular practices developed by their members, including digital material platforms, modular design approaches, and projects involving reversible construction. They do not claim credit for these solutions but see their role as validating, disseminating, and scaling them through professional networks and public advocacy.

Material use and transparency were closely linked in their responses. Associations reported supporting initiatives around material passports, digital databases, and classification systems to improve traceability and facilitate reuse. However, they also highlighted the absence of robust, industry-wide KPIs or metrics for circularity. One respondent raised concerns about superficial CE claims, calling for stronger verification mechanisms to prevent greenwashing and ensure credibility.

Finally, collaboration emerged as a key strategic lever. Associations emphasized their capacity to convene cross-sectoral alliances, including industry players, municipalities, architects, and research institutions. Through this bridging role, they aim to shape future regulatory environments and promote systemic change. However, they also recognized that their influence ultimately depends on the engagement of their members and the responsiveness of public institutions. Without stronger political mandates and clearer financial incentives, the pace of change may remain limited.

4.2 Comparison between Architects, Construction Companies and Associations

The second section of this analysis focuses on comparisons across stakeholder groups, examining how the answers from architects, construction companies, and associations position across the six core dimensions of CE orientation.

Table 1 summarizes the answer for each stakeholder group for each of the six core dimensions of CE orientation. This essentially describes, how each stakeholder group approaches the respective dimension of CE orientation, and an engagement score is assigned (1 = low engagement, 2 = moderate engagement, 3 = high engagement). The score will be used in table 2 to compare the different stakeholder groups and the different core dimensions of CE orientation and therewith providing a heatmap of similarities and differences between stakeholder groups and dimensions of CE orientation. Table 1 only compares the answer for the questions which were similar across all interviews, the stakeholder group specific questions are not considered for this analysis (see also chapter 3.4).

Core Dimensions of CE Orientation	Architects	Construction Companies	Associations
CE Definition	Architects exhibit a broader theoretical frame of CE, integrating design-for-reuse, lifecycle thinking, and systemic approaches. Their conceptual depth justifies a higher score. (3)	Most companies define CE in terms of material reuse and waste minimization, reflecting a primarily technical and operational understanding. This narrower perspective results in a moderate engagement score. (2)	Associations typically reference structured CE frameworks (e.g., 6Rs) and see themselves as knowledge brokers. Their role in shaping the conceptual boundaries of CE supports a high rating. (3)
Adoption Start	Architects demonstrate more visible and consistent CE integration, especially in early-phase design. Younger practices in particular are driving adoption, meriting an intermediate score. (2)	Implementation is generally limited to pilot projects or preliminary planning phases. Few firms report long-term or systemic CE adoption, warranting a low engagement score. (1)	Associations contribute by developing guidelines and influencing regulation. Although implementation varies depending on mandates, their sustained involvement justifies a moderate score. (2)
Advantage/ Opportunity	Architects see CE as a space for innovation and strategic positioning. The emphasis on design leadership and creative potential supports a high engagement score. (3)	Companies often cite tactical benefits—such as branding, cost reduction, or compliance—but seldom articulate broader strategic or systemic opportunities, leading to a mid-level score. (2)	Associations identify CE as a lever to guide discourse and sectoral development, though not necessarily linked to direct economic benefit. This more discursive role earns a moderate score. (2)
Constraints/ Cost	Architects frequently encounter coordination issues and client resistance, particularly due to	Respondents highlight cost pressures, logistical complexity, and limited	Associations emphasize barriers at the governance and policy level, especially the lack of

	current procurement models. The systemic nature of these constraints aligns with a mid-range score. (2)	market readiness. Some also note regulatory ambiguity and data scarcity. These common barriers correspond to a moderate constraint level. (2)	harmonized standards and political urgency, warranting a moderate score. (2)
Collaborations	Architects strongly advocate for interdisciplinary collaboration, often initiating early-stage dialogue with engineers and consultants. This proactive engagement supports a high score. (3)	Companies acknowledge the importance of collaboration but cite sectoral fragmentation and role uncertainty as limiting factors. Their generally reactive stance leads to a mid-level score. (2)	Associations actively create and lead collaborative platforms, bringing together diverse stakeholders across the value chain. Their central role in ecosystem-building however limited outside visibility and voluntary engagement only suggest a medium score. (2)
Enablers/ Drivers	Architects identify several technical enablers (e.g., BIM, material databases), but their influence on regulatory or market drivers remains limited. This situates them at a moderate level. (2)	Most firms mention only external motivators such as cost savings or compliance obligations. Proactive engagement or innovation-driven motivation is rare, justifying a low score. (1)	Associations clearly articulate key drivers, including public procurement, incentives, and policy, and actively contribute to shaping these conditions. Their systemic role merits a high score. (3)

Table 2: Summarized answer of stakeholder groups regarding the six core dimensions of CE orientation, including engagement score (own illustration)

The engagement scores synthesized in Table 1 above are summarized into a heatmap (see Table 2). This heatmap shows the similarities and differences of how each stakeholder groups engages in each of the six core dimensions of CE orientation, as well as how each core dimension of CE orientation is addressed by each stakeholder group.

Building on the comparative assessment outlined above, the following heatmap (Table 2) synthesizes stakeholder engagement across six core dimensions of CE orientation. The numerical values, derived from the qualitative scoring rationale presented in Table 1, enable a visual comparison of maturity, alignment, and divergence among architects, construction companies and associations. This visual representation facilitates the identification of systemic patterns and stakeholder-specific strengths and limitations in advancing circular economy practices.

Core Dimensions of CE Orientation	Architects	Construction Companies	Associations
CE Definition	3	2	3
Adoption Start	2	1	2
Advantage/Opportunity	3	2	2
Constraints/Cost	2	2	2
Collaborations	3	2	2
Enablers/Drivers	2	1	3

Table 3: Heatmap of engagement scored or each stakeholder group regarding the six core dimensions of CE orientation (own illustration)

Across all six core dimensions of CE orientation, architects and associations show comparatively higher levels of engagement. Architects in particular score high on average, reflecting their forward-thinking design approaches, active use of digital tools (such as material passports and BIM), and emphasis on lifecycle thinking. However, it is important to stress that the architects interviewed represent a particularly engaged subset of the profession; while they exemplify what is possible, they unfortunately remain the exception rather than the norm in current practice.

Associations also score highly across the board, particularly in their ability to define CE frameworks, promote collaboration, and identify systemic enablers and drivers. Yet, their strength lies predominantly in theoretical positioning and strategic discourse. While associations play a crucial role in shaping guidelines, setting standards, and fostering dialogue, their capacity to effect large-scale, practical implementation, including outside visibility (e.g. labels) or mandatory member engagement is still under development.

Construction companies show more modest engagement overall. Their definitions of CE tend to focus narrowly on recycling and waste reduction, and their involvement in systemic initiatives, such as circular business models or proactive policy engagement, is still relatively limited. The low scores in “Adoption Start” and “Enablers/Drivers” suggest that while awareness is rising, most companies have yet to embed CE into their core strategies. While this approach might be enough for an individual, highly specialized construction company (e.g. cement producer), it still indicates that for high levels of circular economy orientation, a construction project must select a well-balanced and potentially carefully selected portfolio of construction companies in order to achieve high circularity orientation.

Finally, the scores under "Enablers and Drivers" reflect not the current presence of these factors, but rather the awareness, articulation, and opinion formation around what enablers are necessary for future progress. These include policy incentives, client demand, public procurement mechanisms, and technical infrastructures. Associations and architects demonstrate a more developed understanding of these dimensions, while construction companies are still in earlier stages of engagement.

Taken together, the findings highlight that collaboration is not just beneficial, but essential. Advancing the CE in the construction sector requires concerted efforts across all actors - designers, builders, and institutional enablers - each contributing complementary expertise. Without systemic collaboration and alignment, isolated efforts risk remaining fragmented and insufficient to drive the large-scale transformation the industry urgently requires. To explore how this alignment can be structured in practice, the following section introduces the CEBMC as a framework to capture and connect these dynamics.

4.3 Applying the CEBMC to Construction Actors

To operationalize the CEBMC (see Chapter 2.2.1), we applied the CEBMC's nine pillars to the three stakeholder groups of the Swiss construction ecosystem as defined for this study (see Chapter 3.2): architectural firms, construction companies and professional associations.

Similar to the engagement score used in chapter 4.2 to analyse how each stakeholder group is engaged in each of the six core dimensions of CE orientation, a pillar implementation score of 0 to 4 was applied to describe how each of the stakeholder groups scores on each of the nine pillars of the CEBMC, with 0 indicating no implementation and adaptations regarding the respective pillar, and 4 indicating advanced and systematic implementation and adaptations regarding the respective pillar.

Architects showed strong awareness and intent in early-stage circular design but were constrained by client budgets, weak demand for CE, and lack of traceable implementation tools. Indeed, architects emphasise the importance of traceability in interviews, but no centralised source exists yet. Their strengths lay in material choice and conceptual design, not in delivery or monetization. This aligns with earlier findings that architects often frame CE as a design philosophy but struggle to translate this into viable business models, particularly when faced with cost-sensitive clients and procurement systems favouring conventional construction approaches and solutions. (Chapter 4.1 and Appendix F).

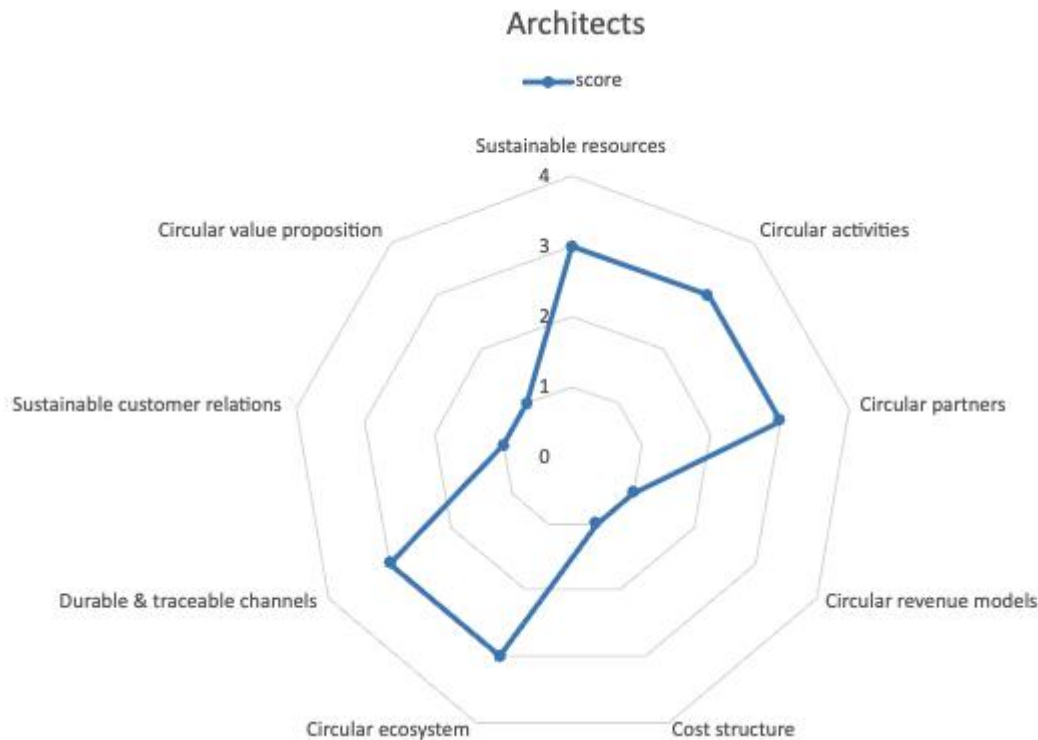


Figure 3: Business Model Canvas pillar implementation score for Architects (own illustration based Osterwalder & Pigneur, 2010. P. 44)

For architects, we see positive scores in terms of ecosystem, Circular partners, Circular value proposition and activities. Just like the development of traceable channels, such as the example of BMI in the interviews. Indeed, based on feedback from interviews, these pillars appear to be in a positive upward trend but still have room for improvement. On the other hand, customer awareness, costs and revenues emerge as weak points particularly due to the fact or remaining low demand and lack of market measures.

Construction Companies emerged as the most engaged group as seen from the data analysis (Chapter 4.1, Table 1), with significant progress in Sustainable Resources, Circular Activities, and Value Proposition. The interviews had indeed highlighted the importance of reducing waste, the efforts of a demolition section, recycling and reuse of components. However, systemic barriers such as upfront cost or lack of client awareness do remain. As seen in the preceding chapters (e.g. Chapter 2.2 and 2.3), these obstacles mirror the broader sectoral challenges identified, where companies frequently highlighted the gap between long-term innovation and short-term project realities, the absence of standardized frameworks, and internal misalignments between sustainability goals and cost optimization pressures. (Chapter 4.1, Construction Companies)

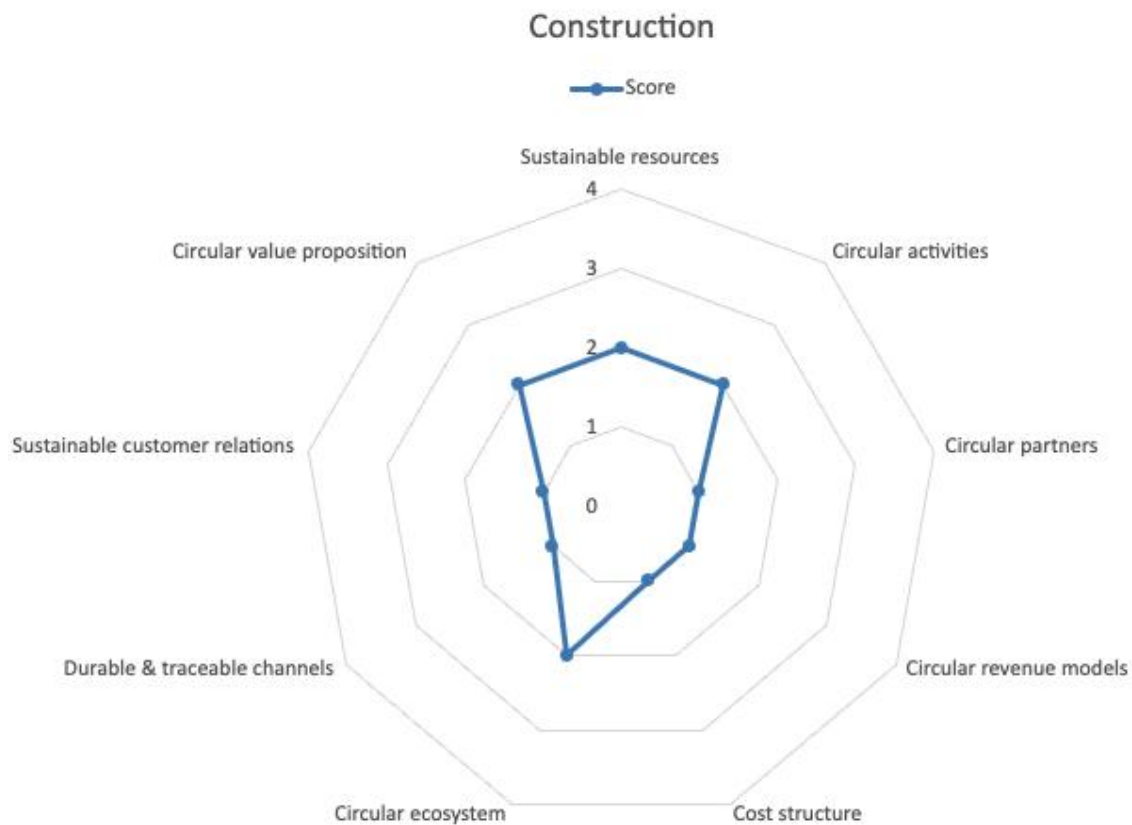


Figure 4: Business Model Canvas pillar implementation score for Construction Companies (own illustration based Osterwalder & Pigneur, 2010. P. 44)

For the construction sector, higher pillar implementation scores appear in circular activities and resources. On the other hand, due to a lack of collaboration, the ecosystem remains weak, and a lack of customer awareness results in a similarly low score for relationships. Revenue and costs remain sensitive issues in all cases (as it will be for the other stakeholder groups).

Associations functioned primarily as enablers: fostering education, dialogue, and standardization. While influential in ecosystem coordination and advocacy, their limited operational role meant weak maturity in cost and revenue-related pillars. As previously discussed, their contribution lies less in direct implementation and more in ecosystem building, providing guidelines, training, and coordination platforms. That sets the stage for others to act, yet without addressing the financial and operational gaps observed throughout the sector. Although this is a positive development, without stronger political mandates and clearer financial incentives, their influence remains limited, despite their proven commitment demonstrated during interviews. (Chapter 4, Appendix H)

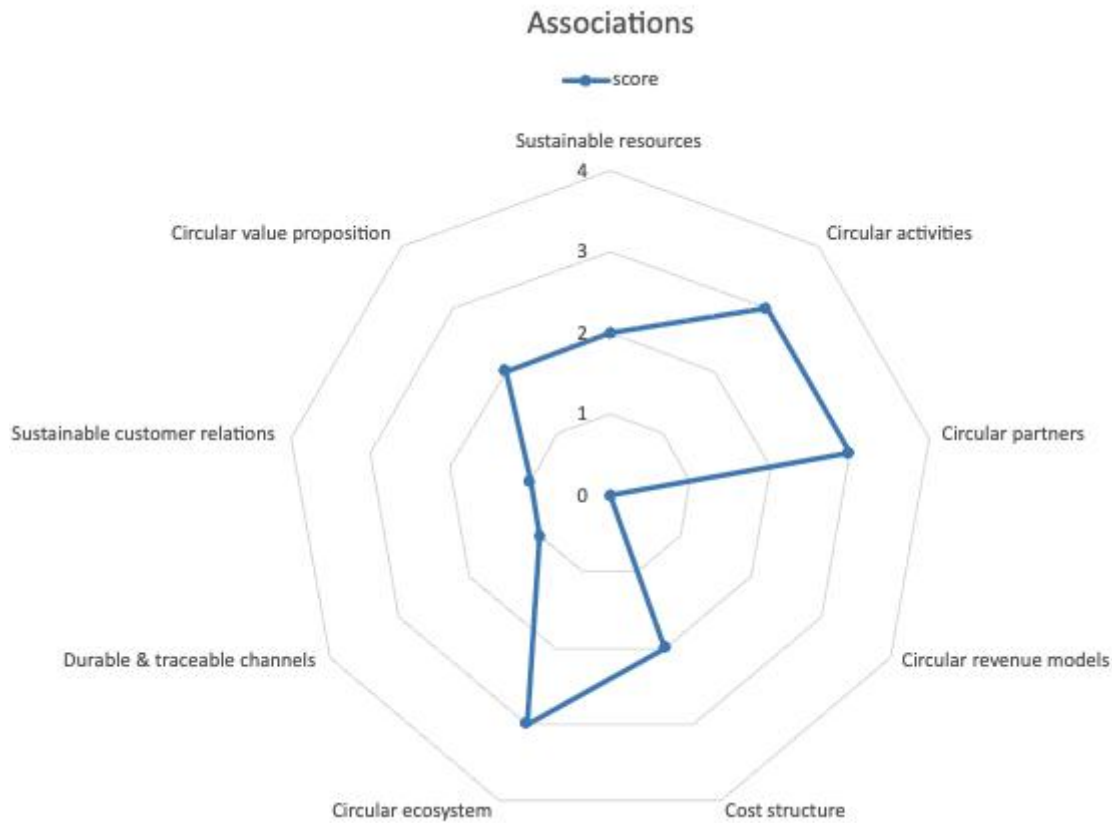


Figure 5: Business Model Canvas pillar implementation score for Associations

(own illustration based Osterwalder & Pigneur, 2010. P. 44)

Finally, for associations, numerous examples from the interviews demonstrate a growing commitment, an evolving ecosystem, and an increasing range of activities for stakeholders. However, due to numerous macro factors, the other pillars still have low scores, such as Cost structure, or Circular revenue models.

The results of this pillar implementation scoring echo the previous findings of our empirical analysis: while companies experiment with technical solutions, business model transformation remains partial. Construction companies have advanced in materials as well as in selected activities, but they struggle with revenue models and cost recognition; architects are strong in design intent, but are constrained by client budgets and weak demand; associations act as coordinators, yet they are limited by the absence of stronger political mandates and clearer financial structures and benefits. These patterns confirm that the systemic barriers observed in Chapters 2.3 and 4.2: fragmentation, lack of incentives, lack of collaboration and data gaps persist at the level of business model design.

The pillar implementation score analysis above suggests the construction sector being in transition, with innovation clusters and promising pilot projects, but lacking systemic cohesion. Key insights include:

- Revenue Models and Cost Structures are consistently weak across stakeholder groups. Without mechanisms to monetize circular benefits or reflect them in accounting, CE remains financially unattractive.
- Client demand immaturity limits the ambition of architects and constructors. Educational initiatives and new procurement rules could shift this dynamic.
- Despite positive developments in a growing ecosystem within the sector, there is a lack of collaboration, mainly due to a lack of standardisation, data and unified KPIs.

Together, these findings point to a central conclusion: isolated innovations, no matter how promising, are not enough. Only by integrating circular principles into business models, rather than treating them as technical add-ons, the construction sector can overcome the structural barriers highlighted in this study. Another point is the importance of collaboration. Higher levels of circularity may only be achieved in the construction sector as companies work together closely.

For companies, the CEBMC provides not only a diagnostic tool but also a roadmap. Those who integrate circularity holistically, from design to revenue, will be better positioned to lead in a resource-constrained future. This is also a way to identify the weak pillars of a business model and thus support companies in prioritizing activities and initiatives. Political players and associations, meanwhile, must facilitate this transition through certification schemes, standardization, and centralized information. These points emerged as the main barriers during the interviews and analysis in Chapter 4.

Future work should investigate how CE business models interact with financial reporting and valuation. Standards such as IAS 16 are flexible enough to embrace advantages from comprehensive circular construction, e.g. for depreciation adjustment based on residual value, reuse potential, as well as asset life-cycle and useful life, which could unlock circular investment logic as well as positively influence activities and initiatives for the other pillars of the CEBMC.

Ultimately, this chapter shows that business model transformation is not without importance, it is the core enabler of a viable circular transition in the construction environment. The following sub-chapter looks at three case studies how the CEBMC might be implemented in

three different construction scenarios, including linking these suggestions to the interviews conducted with architects, construction companies and associations.

4.4 CEBMC case studies

Based on the findings of sub-chapter 4.4, the following paragraphs will now present three case studies. The examples and suggestions mentioned in the interviews are combined into the three scenarios RE:Build, RE:Use, and RE:Cycle, for each of which a case study describes the CEBMC pillars.

****RE:Build:**** A project to rebuild an office building into a modular coworking space, using second-life components and material, with low carbon impact and planned future disassembly.

****RE:Use:**** A large-scale deconstruction initiative aimed at recovering maximum materials for reuse across different other projects.

****RE:Cycle**:** A circular retrofit program focused on modifying existing public buildings, applying circular design principles and integrating reused materials.

CEBMC Pillar	Application in RE:Build	Application in RE:Use	Application in RE:Cycle
Circular Partners	Collaboration with deconstruction firm, reclaimed materials platform, and a tech startup.	Partnership with city demolition services, recycling cooperatives, and local craftsmen.	Cooperation with housing cooperatives, renewable energy providers, and mobility-as-a-service firms.
Circular Activities	Selective deconstruction of existing structure; modular interior design; use of reclaimed components; digital material passport.	Full building dismantling; material recovery workshops; onsite sorting and redistribution.	Circular retrofitting: upgrading old buildings with reused materials, modular systems, and energy-efficient design.
Circular Value Proposition	Flexible, low-impact workspaces with guaranteed reuse value.	Reuse of materials that could potentially offer certifications in the future, life cycle for materials.	Extended lifespan of buildings, lower operational costs, and reduced carbon footprint.
Sustainable Customer Relations	Co-design workshops with tenants; maintenance and adaptation services over 10 years.	Community involvement in dismantling phases	Long-term service contracts with building owners for upgrades and maintenance.
Durable & Traceable Channels	Low-carbon delivery logistics; open-access BIM traceability platform for stakeholders.	Open-source material inventory for citywide use; QR codes on all reclaimed components.	Building passports tracking retrofits, materials, and energy performance, predictive maintenance.

Circular Ecosystem	Municipality, SIA, impact funds, and research institutes.	Recycle Partners, deconstruction firms, demolition industry actors.	Municipal planning office, citizen cooperatives, and green infrastructure investors.
Cost Structure	Higher upfront cost due to selective deconstruction and reclaimed material processing; reduced lifecycle costs.	Offsetting dismantling cost by resale of recovered materials and avoided landfill fees.	Initial retrofitting investment offset by reduced energy bills and extended building life.
Circular Revenue Models	Revenue through leasing space, consulting on CE design, and resale of unused components.	Revenues from material auctions and partnerships with recyclers.	Revenues from retrofit services, consulting, and resale of modular retrofit components.
Sustainable Resources	Earth-based bricks, reused timber, recycled concrete modules, and components designed for demounting.	Steel beams, wood panels, windows, and piping recovered from demolition.	Bio-based insulation, reused glass, solar panels, and energy-efficient systems.

Table 4: CEBMC Case Studies (own illustration)

These case studies demonstrate not only how the CEBMC can guide strategic planning, but also how it directly addresses the real challenges identified in the Swiss market: overcoming higher upfront costs by emphasizing lifecycle savings, aligning fragmented actors through shared platforms, and embedding new revenue streams beyond traditional project fees. In doing so, it shows how business model innovation can bridge the gap between promising pilot projects and systemic transformation. However, it also showcases that the cost pillar as well as the revenue pillar are currently weak, as already found in chapter 4.3, and these two pillars need further research.

5. Results

The interview results confirm the findings from the review of existing literature on the CE in the construction sector, revealing promising initial practices and emerging opportunities despite significant structural challenges.

Both the literature and interviewees agree that the actual reuse and recycling rates of construction materials remain extremely low. According to recent studies, only around 7% of construction materials are effectively reused or recycled (Circle Economy, 2023, p. 9). The interviews did echo in this figure, where participants described such practices as rare,

technically complex, and often discouraged by current workflows as well as by economic constraints.

Furthermore, while literature highlights promising developments such as the SIA beginning to introduce CE-related regulations and tools, interview data suggest that these instruments have yet to materialize meaningfully in practice. Respondents repeatedly emphasized that most circular construction projects remain pilot initiatives, in which solutions are often invented ad hoc. There is still a lack of standard solutions, procedural guidance, and regulatory momentum, leading to high uncertainty and risk for actors trying to adopt CE approaches.

A similar dynamic is observed in the case of material passports. Literature notes their increasing importance as digital enablers of traceability and life-cycle optimization. Interviews confirm that such tools are beginning to be used but only in a handful of projects, and underline that the initiatives are far from mature, with significant development and standardization still required for broader adoption.

The literature further describes CE in construction as a niche phenomenon, hindered by a lack of financial data and incentives to stimulate market demand. Interviews corroborate this observation: firms rarely possess clear data on the cost implications of circular practices. In some cases, CE was reported as more expensive; in others, potentially cheaper, highlighting the absence of generalized metrics or benchmarks. Additionally, very few companies are deeply committed to CE, and many lack the necessary information to make informed strategic decisions. This data and demand lack was cited as a major barrier across all interviewees. As demonstrated in the CEBMC case studies, overcoming higher upfront costs requires a stronger emphasis on life-cycle savings and long-term value creation, which consequently could provide a financial rationale for wider adoption.

Another shared concern is the absence of a cohesive ecosystem. The literature identifies a fragmented landscape where isolated actors experiment with CE without widespread vertical or horizontal integration. Interviewees confirmed this perception, stating that it remains difficult to find partners who are willing or capable of engaging in circular projects, limiting opportunities for collaboration and scale. The CEMBC analysis further illustrates this challenge, showing that progress depends on aligning fragmented actors through shared platforms and embedding new revenue streams into business models to sustain circular practices over time.

In terms of future potential, the literature highlights modular design and deconstruction as critical levers for CE. Interviewees echoed this perspective, pointing to these design strategies as both practical and promising, particularly for facilitating material reuse and lifecycle optimization.

Finally, the literature identifies three main enablers: innovation, regulatory momentum, and scarcity awareness. Interview responses align strongly with this framework. Innovation was frequently cited as a key internal driver; many firms initially engaged with CE through experimental or R&D-oriented projects. Scarcity awareness (both material and environmental) was described as an increasingly tangible motivator, often pushing actors to reconsider linear practices. As for regulatory momentum, interviewees stressed the urgent need for stronger policy support and regulatory clarity, seeing it as a crucial external enabler that is still largely missing. Additional enablers mentioned during interviews include market demand stimulation and technical infrastructure standardization, both of which are seen as essential to scaling CE beyond niche implementations.

Taken together, the comparison underscores the importance of moving from experimental ambition to systemic implementation. Both literature and empirical evidence highlight the urgent need for coordinated regulation, standardized tools, and collaborative ecosystems. Without these foundational conditions, the construction sector risks stagnating in a fragmented state of CE adoption, unable to realize its full potential as a transformative sustainability pathway.

The interviews confirm the theoretical finding that circularity in the construction industry is at a pilot phase, at best. Interestingly, all interviewees identified the lack of an integrated ecosystem approach as one of the key reasons why circularity is not progressing further. What is missing is managerial guidance for integrated and collaborative decision-making that would allow buildings, their use, and their eventual reuse or deconstruction to truly enable circularity. The following chapter concludes this study and suggests future research for developing such an ecosystem-oriented managerial perspective.

6. Conclusion

The findings from this study highlight a multifaceted landscape in which both resistance and readiness coexist across the Swiss construction ecosystem. While the long-term benefits of CE practices are widely recognized among industry actors, structural barriers continue to

inhibit their widespread adaptation and implementation. Regulatory and policy frameworks remain largely misaligned with circular principles, offering few concrete incentives for reuse, modularity, or life-cycle optimization. In parallel, demand for circular solutions is still weak. Most clients remain highly cost-sensitive, and in the absence of clear economic or regulatory incentives, developers frequently default to conventional, linear models, particularly in private-sector projects.

A central limitation that emerged across our interviews is the lack of standardized frameworks, certification schemes, and shared metrics. Without such approaches, CE adoption becomes a bespoke process, placing additional burden on teams to coordinate reuse supply, ensure material traceability, and navigate regulatory uncertainty. This complexity significantly limits scalability, especially in fast-paced or cost-driven project environments.

Nonetheless, important enablers are beginning to take shape. Growing environmental awareness, particularly in public and urban development contexts, is elevating circularity on the policy and market agenda. Emerging technologies in material tracking and modular construction, as well as increasing pressure to reduce emissions, are fostering favourable conditions for circular innovation. Public tenders are starting to include explicit criteria related to sustainability and CE, and a niche market of environmentally conscious buyers is willing to pay a premium for buildings designed for long-term value and material efficiency.

In direct response to the research question, this study shows that architects, construction companies and associations in Switzerland exhibit different degrees of readiness to integrate CE principles into their business models. Architects demonstrate strong conceptual alignment with CE principles but face limitations in translating design ambition into viable business models. Construction companies have made progress in resource use and operational activities but remain constrained by costs and weak demand. Associations, while less operational, play a key enabling role by promoting standards, fostering dialogue, and shaping regulation.

Beyond mapping current practices, this study makes a distinctive contribution by developing and applying the Circular Economy Business Model Canvas (CEBMC) as a tailored framework for the construction industry. The CEBMC not only structures the comparative analysis of maturity across architects, construction companies and associations, but also provides a practical tool to diagnose systemic readiness and gaps. More importantly, the model demonstrates its potential as a forward-looking instrument: it shows how circular activities, resources, and value propositions can be strategically aligned with revenue models,

cost structures, and ecosystem partnerships. In this sense, the CEBMC offers a pathway for actors to move from fragmented technical pilot projects to integrated business-model transformation.

Future research should build on this foundation by delving deeper into the financial and accounting implications of CE in the built environment. In particular, the role of financial reporting and valuation standards warrants further investigation. Existing frameworks, such as IAS 16, offer opportunities to adapt depreciation methods and residual value assessments in ways that could better capture the long-term benefits of circular design. Similarly, evolving the logic of financial disclosures to recognize reuse, durability, and material recovery as sources of value could incentivize broader adoption. Integrating accounting innovations with the CEBMC would be crucial not only for internal decision-making but also for communicating value to investors, regulators, and clients.

Taken together, this study argues that business model innovation is not an accessory but a cornerstone of the circular transition in the construction sector. By combining empirical mapping with the proposal of a structured framework, it responds to the central research question and lays the groundwork for a regenerative, resilient, and economically viable built environment.

Appendix

Appendix A: Overview of Market Actors and 5R Focus

Company	Sector	Description	Main 5R Focus
Modulart	Architecture	Architects' studio designing modular buildings	Refuse, Reduce
Zirkular	Architecture	Architects' studio reusing existing buildings and components	Reuse
Madaster	Software	Digital material passport platform	Reuse
Kibeco	Construction	Company active in recycling construction waste	Recycle
Foldcast	Construction	Produces reusable concrete elements	Reuse, Recycle
Schwörer	Construction	Produces modular, low-waste buildings	Refuse
C33	Association	Promotes circular construction and maintenance	Refuse, Reduce, Reuse
Cirkla	Association	Coordinates reuse of building components	Reuse

Appendix B: Companies Interviewed

Code	Interview Date	Description	Stakeholder group
A1	26.05.2025	Architect and planner integrating circularity into residential buildings	Architects
A2	15.05.2025	Architecture firm promoting reuse and ecosystem collaboration	Architects
A3	14.04.2025	Planning and consulting company with expertise in circular procurement	Architects
A4	10.06.2025	Architecture and material platform focused on building passports and traceability	Architects
A5	09.05.2025	Public architecture office engaged in circular retrofitting and public buildings	Architects
C1	16.04.2025	Company active in construction and deconstruction (off-site) and production of recycled concrete	Construction company
C2	30.04.2025	Company active in construction and specialist also in deconstruction (on-site)	Construction company
C3	28.04.2025	Startup developing modular design using recycled components	Construction company
C4	23.05.2025	Large real estate and construction developer with projects in circular building	Construction company
C5	07.04.2025	International building materials company exploring reuse and low-carbon cement	Construction company
C6	29.04.2025	Multinational construction and infrastructure firm with circular pilot projects	Construction company
C7	01.05.2025	Public transport and infrastructure developer engaging in sustainable construction	Construction company
C8	07.05.2025	Regional construction company testing on-site reuse strategies	Construction company
S1	16.05.2025	Professional association working on sustainability in the built environment	Associations
S2	06.06.2025	National technical association contributing to CE guidelines and standardization	Associations

Appendix C: Questions Interviews Architects

1. Vision and Understanding

- How do you define the circular economy in the context of architecture and construction?
- How important is circularity in your firm's design philosophy and project strategy?
- When did you start considering circular principles, and what triggered this shift?

2. Application in Design and Practice

- How do you implement circular economy principles in your projects? (e.g., modular design, reversible construction, adaptive reuse, material passports, etc.)
- Can you give examples of buildings or projects where circularity was a major component? What specific choices did you make?
- Do you integrate reuse of materials from past projects or deconstruction sites? If yes, how?
- How do you choose materials or partners in a circularity mindset? Are you using any platforms for reused/recyclable building materials?

3. Standards and Metrics

- Are there specific certifications or labels your firm has or aims for (e.g., Cradle-to-Cradle, DGNB Circular Certification, Minergie-ECO, BREEAM, LEED with circular modules)?
- Do you use certain internal or industry KPIs to evaluate circularity in a project (e.g., % reused materials, design for disassembly, lifetime flexibility)?
- On a scale from 1 to 10, how circular would you say your average project is?

4. Constraints and Motivations

- Do you see circularity as an opportunity or as a constraint for your architectural practice?
- What drives your circular initiatives: regulation, client demand, internal vision, or financial incentive?

- Do you proactively discuss and suggest circularity with customers, or do you only include it in a project if it is demanded by the customer ? In which cases do you suggest circularity and typically what topics ?
- What would encourage your firm to go further in circularity: stronger regulations, clearer metrics, market competition, client awareness, or other factors?

5. Financial and Strategic Aspects

- Is designing circular buildings more costly? How do you manage or justify these costs to clients?
- Do you perceive long-term financial benefits from circular designs (e.g., lower life cycle cost, building adaptability, branding)?
- Have you identified unexpected savings or efficiencies (e.g., transport, waste management) in circular projects?

6. Collaboration and Ecosystem

- Who are your key partners when working on circular projects? (e.g., engineers, developers, deconstruction firms, reuse platforms) Do circular projects require different partners (or can you select the same partner for any project) ?
- Do you collaborate with public institutions, academia, or networks focused on circular architecture?
- Are you part of any initiatives/Associations? Could you give some examples please

7. Future Outlook

- How do you see the role of architecture in the circular transition over the next decade?

Appendix D: Questions Interviews Construction Companies

1. How do you define Circular Economy?
2. How do you apply it to your company? (Business Models, product design, specific projects you did maybe about recycling or others), when did you start and why?
3. Do you have some labels/certifications (you as company and in your industry in general)?
4. Do you have some standard metrics in your sector/industry?

5. From 1 to 10 (where 1 is no circularity at all and 10 is completely circular) which score would you give to your company?
6. Do you see circularity as a constraint or a plus for your company?
7. What would push you to do more? Regulations, labels, metrics, the competitors or something else? OR What made you take the steps you already made? (intrinsic motivation, external image, ...)
8. How much does the company invest in circular projects? Is it worth it or do you see it mainly as a cost?
9. How do you disclose circularity on your balance sheet? (directly or indirectly)
10. Which were the main unexpected savings you achieved thanks to these projects?

Appendix E: Questions Interviews Associations

1. How do you define Circular Economy?
2. What is your role in CE initiatives?
3. How would you describe the commitment of Swiss companies to the circular economy?
4. Did you have internal circular initiatives?
5. Which were your main collaborations /relations with companies?
6. What is your role in this collaborations?
7. What would push you to do more? Regulations, labels, metrics, the competitors or something else? OR What made you take the steps you already made? (intrinsic motivation, external image, ...)
8. Do you have any examples of innovations from companies?
9. Which were the main unexpected savings that were achieved thanks to circular projects?
10. Were you involved in the financial aspect related to circular projects and how would you evaluate them?
11. Do you have good case study on the financial aspect?

Appendix F: Summary Answers of Interviews with Architects

Code of the company	A1	A3	A2	A4
CE Definition	Keep materials in loop, Design for reuse & Minimize waste	Extend product lifespan & Move away from linear models	Keep materials in loop, Design for reuse & Reduce input of virgin resources	Keeping resources in the value chain at the highest value possible
Importance circularity in design philosophy	Not important yet, there is the need for a cultural shift	Not one of the most important characteristics for the moment	This company focuses only on circular projects	The more the product design is circular, the better for the future value of materials
Adoption Start	5-10 years ago	5-10 years ago	5-10 years ago	5-10 years ago
Why CE	Innovation goal & Need to move away from linear models	Innovation goal & Need to move away from linear models	Innovation goal & Need to move away from linear models	Innovation goal, First mover advantage & Regulatory anticipation
How integration of CE in design?	Different product design, adaptive reuse & urban mining	material passports & reversible construction	Focus on reuse of building elements, reversible construction, integration of reuse potential in planning	Supports design phase through material passports and digital twin models & promotes upfront planning for reuse
Choice partners how?	In our territory there are few partners that already work with circular techniques and are involved in these projects. Often these companies are called social enterprises		Choose based on shared circular mindset and ability to commit to reuse processes (implicit)	Collaboration with real estate developers, financial institutions, and regulators that share CE ambitions
Are there specific platforms?	In our region not yet	No platform mentioned	No explicit platform mentioned; work is project-based with teams	Yes, offers a proprietary platform for tracking materials and linking them to economic and sustainability data
Labels/certifications	Minergie, SNBS	Minergie, SNBS	Minergie, SNBS	SNBS
Standard metrics?	Not yet but they are under development	Not yet but they are under development (especially material	No common standard yet; field is still under development	Advocates for residual value as a CE KPI; platform includes

		passports), CO2 is the only standard metric (not directly circular)		recycling %, reuse potential, and material lifespan metrics
Strategic tensions	Sustainability vs cost conflict & Missing Culture	Sustainability vs cost conflict	Cost vs sustainability, lack of standardization & cultural resistance	Gap between data availability and regulatory/financial recognition; slow adaptation of institutions like banks and policymakers
Advantage/opportunity	Social opportunity (local work) & safety opportunity (independence) from foreign suppliers)	There are circular practices that are already cheaper than traditional ones	Strong long-term benefits if reuse is planned efficiently & reuse of high-quality Swiss materials creates economic and ecological value	Financial valorisation of circular design; traceability improves asset management and sustainability communication
Constraint/ Cost	For the moment it's still more expensive to use circular techniques	For the moment often it's still more expensive to use circular techniques or it's not possible to measure long term savings	Higher planning effort, need for project-specific evaluation & upfront cost may be higher but balanced by potential construction savings	Lack of clear standards and financial incentives; certification systems are improving but still costly
Necessary steps / drivers	New regulations, Demand incentives, Standardized solutions & Public pressure	CO2 tax, Demand incentives & Standardized solutions	New regulations, Demand incentives & Financial incentives	New regulations, financial incentives and investors' attention
Special collaboration with focus CE	Interdisciplinary hub at SUPSI to discuss the topic and find solutions	Madaster	Every collaboration has a CE focus	Every collaboration
Role of architecture in CE transition?	Architects are the ones (together with engineers) that decide how projects are realized, so they are the ones that have to do a cultural shift and become circular	The collaboration between all the actors in the construction sector is key for the transition to circular economy	Central to enabling reuse and reversible design, architecture drives the integration of CE principles in early project stages	The collaboration between all the actors in the construction sector is key for the transition to circular economy

Appendix G: Summary Answers of Interviews with Construction Companies

Code of the company	C1	C2	C3	C4	C5	C6	C7	C8
CE Definition	Minimize waste & reduce input of virgin resources	Keep materials in loop & Reduce input of virgin resources	Keep materials in loop, Extend product lifespan & Design for reuse	Reduce input of virgin resources & Move away from linear models	Keep materials in loop & Minimize waste	Extend product & lifespan, Reduce input of virgin resources & Design for reuse	Keep materials in loop & Minimize waste	Keep materials in loop, Extend product lifespan & Design for reuse
CE Implementation	Material reuse, Recycled materials & Off-site separation	Keep materials in loop, Recycle materials & On-site separation	Modular design & Recycled materials	Circular business models & Material reuse	Recycled materials & On-site separation	Circular business model, Modular design & on-site separation	Circular business model, Material reuse & Recycled materials	Circular business model, Material reuse & Recycled materials
Adoption Start	5-10 years ago	5-10 years ago	< 5 years ago	< 5 years ago	5-10 years ago	5-10 years ago	> 10 years ago	5-10 years ago
Adoption Motivation	Innovation goal, First mover advantage & Regulatory anticipation	Innovation goal	Innovation goal & Regulatory anticipation	Innovation goal & First mover advantage	Competitive pressure & Regulatory anticipation	Competitive pressure & Innovation goal	Cost savings & Innovation goal	Competitive pressure
Labels & Certifications	Use CO2 Certifications	ISO 14001	Use CO2 Certification and Minergie standards		Unaware of CE labels	Use existing (e.g. Minergie ECO, CO2 Certifications)	Unaware of CE labels	Unaware of CE labels
KPIs & Metrics	Only standard KPI is % recycled content in concrete & some internal metrics under development	Only standard KPI is % recycled content in concrete & the calculate the % of recycled materials per	Only standard KPI is % recycled content in concrete		Only standard KPI is % recycled content in concrete, internally they use: % Waste derived	Only standard KPI is % recycled content in concrete; some internal metrics under development	Everything is still under development	Only standard KPI is % recycled content in concrete, internally they calculate

		project			Resources, CDW, Recycling Ratio & Circularity Ratio			the volume recycled materials sold
Strategic Tensions	Market doesn't reward CE, Lack of demand & Sustainability vs cost conflict	Lack of demand & Sustainability vs cost conflict	Design vs cost conflict	Lack of demand	Lack of demand, Sustainability vs cost conflict	Market doesn't reward CE & Lack of demand	Sustainability vs cost conflict	Sustainability vs cost conflict
Opportunities	First mover advantage & Reputation/image	Long-term cost reduction, First mover advantage	Long-term cost reduction, First mover advantage, Business resilience	Productivity increase	Reputation/image, First mover advantage & Business Resilience	Reputation/image	Risk mitigation & Business resilience	Long-term cost reduction & Business resilience
Constraints & Costs	Upfront cost, No financial return & lack of standardization	Lack of demand, No financial return & complex logistics	Lack of demand, No financial return & lack of standardization	Lack of demand	Lack of demand & often no financial return	Lack of demand, no financial return	Technical barriers & complex logistics	lack of demand & No financial return
Enablers & Drivers	New regulations & Demand incentives	Sustainability trend, Financial incentives & New regulations	New regulations, Design & Financial incentives	Cross-sector collaboration, New regulations & Demand incentives	Demand incentives & New regulations	Demand incentives, Standardized solutions & Public pressure	Public pressure, Cross-sector collaboration & Sustainability trend	Demand incentives & Public pressure
CE & Accounting Practice	Not visible in accounting	Not visible in accounting	Not visible in accounting	Not visible in accounting	Not visible in accounting	Integrated in project budgets, Not visible in accounting	Integrated in project budgets, Not visible in accounting	Integrated in project budgets, Not visible in accounting

Unexpected Savings or positive consequences to CE	Reduced transportation costs	Reuse of an entire wood floor			Good image		Reduced material costs	Reuse of materials on-site
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Appendix H: Summary Answers of Interviews with Associations

Code of the company	S1	S2
CE Definition	Keep materials in loop, Design for reuse & Minimize waste	6 R (Rethink, Refuse, Reduce, Reuse, Repair, Recycle)
Role in CE	Supports member companies through advocacy, industry coordination, and promotion of CE practices within the construction sector	Advocates for circular construction, develops technical guidelines, educates through programs and workshops
Swiss Industry Commitment	Progressive but slow engagement; industry is gradually increasing awareness and action	Gradual progress—commitment growing through pilot programs and technical tool adoption; overall industry still fragmented
Internal CE Initiatives	No direct internal initiatives; mainly acts as a coordinator and facilitator in multi-stakeholder CE collaborations	No operational projects directly led; role is advisory and facilitatory rather than project-based
Collaborations	Involved in different initiatives (Circular Building Charta, Swiss Circular Construction Digital Ecosystem (SWIRCULAR), CBI Booster)	Involved in different initiatives (Swiss Circular Construction Digital Ecosystem (SWIRCULAR), CBI Booster)
Adoption Start	5-10 years ago	<5 years ago
Constraints & Costs	At the moment circular constructions costs 20-30% more	-
Drivers CE	Pressure from regulations, Public pressure, Demand Incentives & Cost decrease	Sustainability goals, Pressure from regulations & Public pressure
Examples of Innovations	EMPA Nest, ETH has different projects, Recycled Beton & Sustainable Bricks	Implementation of material passports & Circular economy platforms

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