



Barriers, Enablers, and Considerations Towards Circular Affordable Housing in Jordan: Insights Across Policy and Practice from Stakeholders' Interviews

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Abstract. Circular economy transitions in housing remain largely theorised in Global North contexts, with limited empirical evidence from affordable housing systems in the Global South. This study assesses the circular readiness of Jordan's affordable housing sector using 32 stakeholder interviews structured around 15 clusters of circular design practice contextualised for Global South. Findings are interpreted through a three-tier readiness framework reflecting the balance between barriers and enablers. Results indicate moderate but uneven readiness. Tier 1 clusters, such as water efficiency, basic energy measures, seismic robustness, and right-sizing, are routinely applied but largely compliance- and cost-driven. Tier 2 clusters, including waste-to-energy, locally sourced materials, indoor environmental quality measures, incremental housing, and demountable construction, remain pilot-based and constrained by regulatory rigidity, technical uncertainty, and weak market structures. Tier 3 clusters, such as adaptive reuse, material reuse pathways, stock-flow tools, green roofs, and cultural value preservation, remain aspirational due to systemic barriers. Across tiers, regulatory and policy constraints emerge as the dominant limiter of scaling. The findings provide transferable insights for advancing circular affordable housing in comparable Global South contexts.

Keywords: Circular Economy · Circular Design · Global South · Policy and Practice · Readiness · Sustainability Transition

1 Introduction

The construction sector is widely recognised as a critical frontier for Circular Economy (CE) transitions due to its resource use, waste generation, and long asset lifecycles [1]. In housing, circularity extends to socio-technical value retention across the building lifecycle [2]. Yet much of this scholarship is grounded in high-income contexts characterised by mature regulatory systems and established secondary-material markets, limiting its transferability to cost-constrained contexts [1]. Affordable housing in the Global South operates under affordability pressures, conventional construction logics, and limited

institutional capacity [3]. Emerging research indicates that circular transitions in such contexts depend less on technological sophistication and more on regulatory reform and coordinated institutional action [4]. However, empirical assessments of sectoral readiness—how circular transitions are enabled or constrained in specific housing delivery systems—remain scarce.

Jordan represents a critical case. Sustained population growth and rapid urban concentration intensify housing demand under severe resource constraints [5, 6], particularly chronic water scarcity and high dependence on imported energy [7, 8]. Under these pressures, housing provision has prioritised cost minimisation and speed of delivery. Consequently, despite sustainability ambitions, affordable housing systems remain institutionally fragmented, with limited evidence of how sustainable design practices are systematically operationalised across governance and practice interfaces.

This study addresses this gap by evaluating the circular readiness of Jordan's affordable housing sector through analysis of barriers, enablers, and forward-looking considerations. Drawing on 32 stakeholder interviews based on a previously established database of 15 clusters of circular design practices contextualised for the Global South, the study develops a tiered readiness framework distinguishing embedded, selectively activated, and aspirational practices. The findings advance understanding of how circularity becomes structured or constrained within cost-sensitive housing systems and generate transferable insights for comparable Global South contexts.

2 Literature Review

This study builds on 15 clusters of circular design practices for affordable housing in Global South contexts, derived from a framework-informed review. Identified through cross-global case analysis, the clusters reflect affordability constraints, limited regulatory and industrial capacity, and strong socio-cultural embeddedness. Rather than abstract principles, they represent empirically tested construction and governance practices structured across seven sustainable development domains: material, energy, and water cycles; ecology; culture; wellbeing; and other value forms.

Within the technical domain, material-related practices dominate the literature. These span strategies aimed at avoiding new material demand (hereafter referred to as refuse), reduction, flexibility and reassembly, robustness, renewable resource use, reuse, repurposing, recycling, recovery, and documentation. “Refuse” avoids new material demand through converting existing structures into affordable housing [9]. Material reduction is achieved through right-sizing, lightweight and off-site construction, and life-cycle-based material selection [10]. Flexibility and reassembly rely on low-tech modular and prefabricated systems enabling incremental growth [11], while robustness practices prioritise seismic-responsive and durable structures [12]. Renewable material use emphasises locally sourced materials such as timber [13]. Reuse pathways close material loops such as plastic upcycling and selective deconstruction-based urban mining [14, 15]. Documentation practices, including material stock-flow models and decision-support tools, underpin informed decision-making [16]. Energy-related practices are centring on energy reduction, flexible energy use, and recovery. Energy demand is reduced through passive strategies combined with renewable systems [10]. Flexible energy strategies

emphasise energy shared systems [11], while recovery is addressed through waste-to-energy applications [14]. Similarly, water-related practices focus on reduction, flexibility, and recycling, primarily through decentralised systems such as on-plot retention, rainwater harvesting, rooftop storage, and greywater reuse [14]. Ecology-related practices reduce ecological pressure using green roofs, biodiversity-sensitive landscaping, and end-of-life strategies to limit landfill dependence [9]. Within the social domain, culture-related practices prioritise affordability, flexibility, and inclusion through shared and adaptable spaces, co-design processes, and job creation [11, 15]. Wellbeing-related practices address toxicity reduction and indoor environmental quality through non-toxic materials, improved ventilation and daylighting, and thermal and acoustic comfort measures [9]. Other value forms preserve cultural and functional value over time by maintaining local identity and aesthetic continuity [11]. Circular affordable housing in the Global South relies on context-sensitive, low-tech, socially embedded practices.

Additionally, this study adopts a seven-category analytical framework to assess circular readiness in Jordan's affordable housing sector, encompassing: regulatory and policy; institutional and organisational; financial and economic; technical and technological; knowledge and awareness; market and supply chain; and cultural and behavioural dimensions. These categories reflect widely recognised domains for evaluating CE adoption in construction [22, 23]. Within this framework, barriers, enablers, and future considerations are differentiated by their current level of operationalisation. Barriers denote existing constraints that hinder circular implementation, such as regulatory rigidity, governance fragmentation, financial limitations, technical gaps, weak markets, and socio-cultural resistance [17–19]. Enablers refer to existing capacities and initiatives that actively support implementation, including supportive policies, institutional coordination, technical expertise, and emerging market structures. Future considerations capture forward-looking reforms and interventions identified by stakeholders as necessary to strengthen readiness and scale circular practices, such as regulatory reform, expanded pilots, innovative financing, capacity-building, and market development [4].

3 Methodology

This study adopts a qualitative, exploratory design to examine barriers, enablers, and future considerations shaping circular design implementation in Jordan's affordable housing sector. It draws on 15 clusters of circular design practices identified in the literature (Sect. 2) synthesised across seven socio-technical impact areas [20]. These clusters informed the development of the semi-structured interview questions. Semi-structured interviews were used as they are well suited to examining implementation barriers and enabling conditions in complex housing systems [19], and were further informed by prior literature (Sect. 2).

Stakeholders were identified through institutional mapping of Jordan's housing and sustainability landscape, followed by purposive and snowball sampling to include actors across governance (ministries, municipalities, regulatory bodies) and practice domains (developers, NGOs, practitioners, academia) [21, 22]. Participants were selected based on professional role, experience, and a minimum of three years' engagement in housing or sustainable construction. In total, 32 stakeholders participated. Interviews were

conducted between December 2024 and April 2025 (45–90 min), in Arabic or English, and transcribed verbatim. Data were analysed using deductive thematic analysis aligned with the predefined circular design framework and associated barrier–enabler categories [23], supported by NVivo 14. Ethical approval was obtained from the Welsh School of Architecture Research Ethics Committee (Approval No. 24029), and all participants provided informed consent.

4 Results and Discussion

Of the respondents, 56% represented top-down actors from regulatory and municipal institutions, while 44% reflected bottom-up perspectives from practitioners, private developers, and academia, ensuring balanced governance and implementation insight. Participants were highly experienced: 50% reported 11–20 years, 19% more than 20 years, and 31% between 6–10 years of professional experience. Institutional representation included key ministries (Public Works and Housing; Environment), the Housing and Urban Development Corporation, Greater Amman Municipality, professional bodies (Jordanian Engineers Association; Jordanian Green Building Council; Royal Scientific Society), private developers, waste firms, and international organizations such as UN-Habitat, GIZ, and GGGI. Most respondents held senior or advisory roles involved in decision-making, technical guidance, or project implementation, providing informed perspectives on circular design barriers, enablers, and future pathways in Jordan's affordable housing sector.

To interpret the results, clusters of circular design practices were organised into tiers of activation based on relational patterns in the heatmap (Table 1), reflecting the balance between current barriers and enablers. Heatmap values indicate the frequency with which respondents identified each factor (0–9 negligible; 10–19 secondary; ≥ 20 primary). Darker cells may signal either entrenched constraints or strong enabling conditions and are therefore interpreted relationally across clusters. Three tiers of readiness were identified. Tier 1 (relatively activated) clusters exhibit at least two activated enabler categories (primary or secondary), including technical and regulatory and/or institutional support, demonstrate routine implementation, and face no more than two primary barrier categories. These reflect pragmatic circularity embedded through compliance, cost-efficiency, or technical maturity. Tier 2 (selectively activated) clusters show partial readiness, with one or two activated enablers but constrained by two to three primary barriers, limiting uptake to pilots or specific projects. Tier 3 (latent) clusters display minimal readiness, characterised by one or no activated enablers and dominance of three or more primary barriers, remaining largely aspirational and misaligned with prevailing regulatory and delivery logics. Read relationally, this tiered structure frames the findings as patterns of readiness, distinguishing embedded practices from those that are conditionally applied or not yet operationalised in Jordan's affordable housing sector.

Tier 1 includes four clusters representing the highest observable circular readiness level in Jordan's affordable housing sector, although readiness remains partial rather than fully circular. First, water-efficiency is the most consistently activated cluster, although mainly through fixture-led measures. Low-flow fixtures are widely used because they are affordable, available, easy to install, and culturally accepted. However, system-scale measures such as greywater reuse and rainwater harvesting remain

Table 1. Summary of Captured Barriers, Considerations, and Enablers

Circular Design Clusters for Global South Contexts	Technical Domain					Social Domain										
	Adaptive reuse	Incremental and expandable housing	Dry connections, demountable components	Seismic-responsive and durable structures	Right-sizing, lightweight systems	Material flow models, decision tools	Local materials	Material reuse pathways	Basic energy efficiency measures	Waste-to-energy applications	Water efficiency measures	Green roofs, planting	Shared spaces, job creations, user acceptance	Non-toxic materials, IEQ measures	Preservation of local identity	
Barriers	R1	31	32	28	3	16	29	30	28	5	20	19	14	27	11	16
	I1	2	1	0	19	1	4	0	0	20	3	3	0	32	9	9
	F1	32	10	13	32	3	21	3	9	26	23	23	29	16	22	32
	T1	22	7	3	7	0	32	11	32	13	25	14	32	6	13	32
	K1	0	18	19	21	21	31	13	5	19	15	20	14	20	25	0
	M1	2	9	18	3	15	6	29	26	5	16	0	15	1	6	8
	C1	30	32	32	10	32	19	29	23	14	8	18	4	15	23	11
Considerations	R2	32	31	24	17	15	21	15	22	20	22	23	13	2	17	1
	I2	19	18	21	26	20	20	30	31	24	31	12	8	24	5	6
	F2	32	17	16	24	8	17	14	27	21	22	20	10	1	3	7
	T2	26	12	16	32	30	27	24	19	21	19	15	32	13	8	26
	K2	1	13	24	13	21	29	15	11	16	2	11	7	32	27	3
	M2	0	3	7	2	3	0	7	5	1	2	0	1	0	2	1
	C2	0	4	4	0	4	2	2	1	6	2	11	2	17	18	19
Enablers	R3	0	0	0	12	3	2	1	4	6	4	6	2	1	5	2
	I3	3	6	7	9	15	15	10	11	12	11	12	10	11	10	9
	F3	0	0	0	6	8	3	2	5	6	4	15	2	4	5	4
	T3	18	12	14	15	25	18	11	13	17	10	20	8	5	14	6
	K3	0	1	1	3	4	6	8	7	9	6	13	7	8	5	5
	M3	9	3	3	4	7	4	4	6	6	3	10	4	2	4	4
	C3	5	4	2	3	4	3	4	4	5	2	11	5	11	4	9

*Note: R = Regulatory and policy; I = Institutional and organisational; F = Financial and economic; T = Technical and technological; K = Knowledge and awareness; M = Market and supply chain; C = Cultural and behavioural. The suffixes indicate analytical category: 1 = Barriers, 2 = Future considerations, and 3 = Enablers. Values indicate the number of respondents, based on 32 interviews. The frequency levels are interpreted as follows: Negligible = 0–9 respondents, equivalent to 0–28%; Secondary = 10–19 respondents, equivalent to 31–59%; and Primary = ≥20 respondents, equivalent to ≥63%.

marginal despite pilots in Mafrqa, Ajloun, and Ghor Safi, where regulatory ambiguity, approval delays, maintenance concerns, and fragmented institutional responsibility still restrict uptake. Circularity therefore advances where solutions are low-risk, low-cost, and simple to manage. Second, basic energy measures, including shading, solar water heaters, and rooftop PV, are technically familiar but largely compliance-driven. Financial pressures, lowest-cost procurement, institutional weakness, and limited monitoring reinforce minimum-standard implementation, described by one practitioner as “*a tick-the-box approach*.” Progress requires performance-based codes, monitored pilots, and lifecycle-oriented evaluation. Third, seismic robustness is embedded through the Jordanian Seismic Code, ensuring baseline structural safety, yet affordability pressures, lowest-bid procurement, and knowledge gaps, including perceptions that “*heavier means stronger*”, limit lightweight or performance-based alternatives. Similarly, right-sizing and material efficiency are applied pragmatically through compact layouts and simplified finishes, while cultural preference for reinforced concrete, limited familiarity, and weak market confidence constrain wider adoption of light-gauge steel or prefabricated panels.

Across Tier 1, readiness reflects pragmatic circularity shaped by compliance, affordability, technical maturity, and selective experimentation, rather than explicit circular design integration. Further progress depends on regulatory reform, monitored demonstrations, and professional capacity-building across policy and practice.

Tier 2 includes five clusters that reflect selective, project-dependent activation rather than embedded routine practice. First, waste-to-energy is technically proven beyond the housing sector, particularly through municipal landfill gas recovery at Al-Ghabawi and other industrial, agricultural, and wastewater-related applications. However, its connection to affordable housing remains weak because waste data, segregation systems, capital investment, licensing arrangements, and cross-sector coordination are still insufficiently developed. Progress therefore depends on coordinated pilots, clearer regulatory pathways, improved waste sorting, and targeted incentives that link energy recovery to housing delivery. Second, locally sourced materials are experimentally viable but not yet systemically embedded. University and research pilots, eco-lodge projects, NGO-led applications, and small private experiments demonstrate clay plasters, earth blocks, agricultural-waste composites, and other context-sensitive alternatives. Yet these materials remain outside mainstream affordable housing because certification, standards, procurement routes, supply-chain confidence, and cultural acceptance continue to favour conventional concrete-based construction. Scaling requires certified testing, code reform, pilot housing blocks, and production incentives. Third, non-toxic materials and IEQ measures show partial uptake through insulation, glazing, shading, ventilation, daylighting, and low-VOC finishes. However, implementation is still framed mainly around comfort and energy reduction rather than holistic health-oriented design, with affordability pressures, contractor knowledge gaps, weak enforcement, and limited awareness restricting deeper integration. Embedding IEQ standards and strengthening professional training are therefore central to advancement. Finally, two clusters reflecting the incremental,

modular, and dry demountable systems are technically compatible with Jordan's reinforced concrete frames and visible in family-driven extensions, NGO projects, camp-based or temporary structures, worker housing, and pilot applications. However, affordable housing integration remains limited by regulatory rigidity, absent standards for staged expansion and reversible connections, cultural preference for fixed construction, contractor unfamiliarity, and finance models favouring completed units.

Overall, Tier 2 circularity reflects conditional circularity: these practices are not absent, but they remain fragmented, risk-dependent, and weakly procurement-integrated. Their advancement requires regulatory alignment, certification pathways, housing demonstrations, market development, and targeted capacity-building.

Tier 3 includes six clusters that represent latent circular readiness, largely misaligned with prevailing regulatory, financial, and delivery logics. First, converting existing structures is visible mainly in small heritage restorations in downtown Amman and Salt, often NGO - or tourism-driven, but it is not yet a systematic affordable housing pathway. Second, material stock-flow tools, including LCA, material passports, and digital tracking, remain confined to academic, donor-funded, or internal organisational applications, with minimal integration into approval, procurement, or lifecycle decision-making. Third, material reuse pathways are tested through recycled aggregates, repurposed plastics, agricultural-waste composites, and factory recycling, yet weak certification, absent standards, fragmented supply chains, and low market trust continue to favour virgin materials. Fourth, green roofs and planting appear in institutional, high-end, or municipal greening projects, but remain difficult to mainstream in arid, cost-sensitive housing due to irrigation, maintenance, waterproofing, structural, and affordability concerns. Fifth, shared spaces, accessibility, and participatory practices appear in NGO, UN-supported, municipal, prototype, and informal self-build contexts, but remain poorly formalised. Finally, local identity preservation is visible through stone façades, courtyards, shaded spaces, and heritage-sensitive projects, yet cost-driven standardisation reinforces repetitive housing models.

Across Tier 3, circularity remains structurally constrained and aspirational, requiring regulatory reform, technical frameworks, demonstrations, and institutional capacity-building.

5 Conclusion: Where Are We Now and Where Are We Heading?

This study assessed the circular readiness of Jordan's affordable housing sector through stakeholder analysis of barriers, enablers, and future pathways. Findings show moderate but uneven readiness: practices are most embedded where they align with cost-efficiency, regulatory compliance, or technical familiarity, while others remain limited to baseline use, isolated pilots, or sector-specific experimentation. Regulatory constraints reinforce cost-driven delivery that prioritises short-term affordability over lifecycle value and adaptability, making circular housing primarily a governance and implementation challenge. Progress requires regulatory and procurement reform, circular approval and financing criteria, stronger certification and monitoring, and scaled demonstrations. While grounded in Jordan, the findings offer transferable insights for comparable Global South affordable housing systems.

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