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RISK PERCEPTIONS IN CIRCULAR ECONOMY ADOPTION IN THE AUSTRALIAN CONSTRUCTION INDUSTRY

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ABSTRACT

Risk refers to the uncertainty associated with achieving a particular objective. Innovative approaches often involve greater risk because they are not fully realised or widely validated in real-world contexts. The Circular Economy (CE) represents such an innovation, replacing traditional linear material flows with regenerative principles. Given its transformative nature and the conservative characteristics of the construction industry, CE adoption in Australia involves considerable uncertainty. This can lead to risk aversion among decision-makers, particularly clients who act as project initiators and investors. Therefore, how these decision-makers perceive risk is critical, as it strongly influences the initial decision to adopt CE. Therefore, this study examines the perceived risks faced by decision-makers in the Australian commercial construction industry. Eleven industry experts were interviewed, and the data were analysed using content and thematic concurrence analysis in NVivo. The findings show that financial ambiguity, material quality, supply chain reliability, stakeholder coordination, end-of-life planning and longer construction time are perceived as critical risks shaping early-stage decision-making. Experts explained that perceptions even exceed objective risk realities, consistent with the principles of Prospect Theory, which highlight the divergence between perceived and actual risk. In contrast, uncertain regulatory changes, corruption and health and safety concerns were generally not considered decisive in the initial decision-making process. The study highlights that perceived risks, rather than objective risks, dominate decision-makers in the early stages of CE adoption, underscoring the need to address perception gaps to facilitate effective implementation of circular practices in Australian commercial construction projects, leading to future research.

Keywords: *Circular Economy; Client; Commercial Construction Projects; Decision-makers; Perceived Risk.*

1. INTRODUCTION

In Australia, the built environment contributes substantially to environmental degradation, particularly through its generation of C&D waste (Feldman et al., 2024). The National Waste Report 2022 recorded 25.2 million tonnes of such waste in 2020–21,

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almost one-third of Australia's total waste output. Although the resource recovery rate is relatively high (approximately 81%), the scale of waste highlights the persistence of a linear construction model that prioritises virgin material extraction, short building lifespans, and demolition over circular practices (Department of Climate Change Energy, the Environment and Water [DCCEEW], 2022). A 39% increase in C&D waste per capita over the past 15 years illustrates the growing environmental strain on Australia's resource systems (DCCEEW, 2024). These trends indicate continued dependence on virgin materials, intensive energy use, and high disposal rates, all of which contribute to resource depletion and emissions burdens in the built environment. In response, the industry is increasingly incorporating sustainable practices to reduce its environmental impact (Amudjie et al., 2023). Approaches such as green construction, net-zero buildings, smart construction technologies, sustainable supply chains, and the Circular Economy (CE) are being adopted to improve sustainability (Amudjie et al., 2023; Ho et al., 2023). CE is particularly transformative, focusing on the full lifecycle of materials through strategies such as maintenance, reuse, refurbishment, remanufacture, and recycling (Ellen MacArthur Foundation [EMF], 2024). However, adoption remains limited; as of 2019, only 4% of construction practices in Australia incorporated circular principles, leaving a 96% gap (DCCEE, 2024). The adoption of CE represents a significant innovation within a conservative industry, creating uncertainties that influence decision-makers' willingness to initiate, invest, or support CE practices.

Risk perception plays a critical role in shaping such decisions. Unlike objective risk, which is measurable and data-driven, perceived risk is subjective, shaped by cognitive biases, heuristics, and emotional responses (Vasvári, 2015). Prospect Theory (Kahneman & Tversky, 1979) and Dual Process Theory (Kahneman, 2011) explain that decision-makers often weigh potential losses more heavily than gains, and rely on intuitive rather than analytical reasoning in early-stage decisions. There are numerous decision-makers, such as clients, government representatives, research and development institutes, designers, contractors, and suppliers, involved in initiating, supporting, and investing in CE-oriented strategies (Ho et al., 2023; Tan et al., 2022; Vasvári, 2015). Without proactive leadership from these groups, individual-level engagement is insufficient to drive systemic change (Tan et al., 2022). Yet existing studies consistently highlight limited commitment from decision-makers across key stakeholder groups (AlJaber, 2023; Circle Economy Foundation [CEF], 2024; Tan et al., 2022). Evidence suggests that designers, contractors, and suppliers are more likely to adopt CE practices when clients, R&D organisations, and governments demonstrate clear commitment (Adabre et al., 2024), while the success of CE-focused business models critically depends on clients' awareness and interest (Bertassini et al., 2021). Therefore, understanding how these risk perceptions affect decision-makers, particularly clients, is essential to accelerating CE adoption. Consequently, perceived risk may exceed objective risk, creating barriers to innovation adoption, particularly in client-led commercial construction projects where financial stakes, regulatory complexity, and multiple stakeholders intensify decision uncertainty (AlJaber et al., 2023; Tan et al., 2022). Hassan et al. (2023), Berglund-Brown et al. (2024), Tam (2024), and Wuni and Abankwa (2023) examined the objective risks associated with CE adoption in construction projects. Nevertheless, their analyses largely focused on risk identification and assessment, without distinguishing between objective risks and the perceptions of decision-makers who ultimately influence CE adoption decisions. Therefore, this study aims to examine the perceived risks of client, developer, and investor decision-makers in Australian commercial construction projects, with a focus on understanding what are the different perceptions influences initial CE adoption decisions.

2. LITERATURE REVIEW

In natural ecosystems, every output becomes an input to another process, forming a continuous, regenerative cycle in which waste does not exist (Braungart & Braungart, 1990; Rim et al., 2025). By contrast, modern economies**,** including construction**,** have historically followed a linear "take–make–dispose" model, contributing to resource depletion and environmental degradation (Winans et al., 2017). As pressures from climate change and finite resources intensified (Baldassarre, 2025; CEF, 2024; United Nations, 2015), the need for an alternative system emerged: the circular economy. CE gained substantial global recognition in the late 2000s and early 2010s, driven largely by the work of the Ellen MacArthur Foundation (EMF) and reinforced by policymakers (e.g., European Union, World Economic Forum), multinational corporations (e.g., Renault, Philips), and consulting organisations (e.g., Deloitte, Circle Economy). These actors broadened CE's visibility by framing it as a closed-loop economic system centred on waste minimisation, resource optimisation, and sustainability across product lifecycles (Pauli, 2010; Winans et al., 2017). EMF provided one of the most widely adopted definitions in 2012, describing CE as: "*an industrial system that is restorative or regenerative by intention and design. It replaces the 'end-of-life' concept with restoration, shifts toward renewable energy, eliminates toxic chemicals that impair reuse, and aims for the elimination of waste through superior design of materials, products, systems, and business models*" (p. 7). Its updated 2024 definition states: "*a system where materials never become waste and nature is regenerated. Products and materials are kept in circulation through maintenance, reuse, refurbishment, remanufacture, recycling, and composting*." Efforts in waste reduction, reuse, and recycling are already in place in construction projects, though not to their full potential (Feldman et al., 2024). Furthermore, the regenerative closed-loop supply chain, in which materials continuously circulate without losing value, is not encompassed in the construction industry (CEF, 2024; EMF, 2024; Wanaguru et al., 2022). Therefore, CE adoption is yet considered an innovation in the Australian construction industry.

Traditional economic models, such as Utility Theory, assume that decision-makers evaluate risk rationally, focusing on those objective risks and making choices that maximise their expected utility. Prospect Theory (Kahneman & Tversky, 1979) challenges this notion by demonstrating that individuals evaluate risk differently depending on whether they perceive a situation as a gain or a loss. Accordingly, perceived risk, as explained through Prospect Theory (Kahneman & Tversky, 1979), is a subjective concept shaped by how individuals evaluate gains and losses under conditions of uncertainty. Unlike objective risk, which relies on empirical data, perceived risk is influenced by cognitive biases, heuristics, and framing effects (Vasvári, 2015). Dual Process Theory (Kahneman, 2011) defines human behaviour as the decision-maker using two thinking systems: System 1 (fast, intuitive, and emotional) and System 2 (slow, analytical, and rational). Often, System 1 dominates, leading to subjective risk assessments influenced by emotions and heuristics (Kahneman, 2011; Kahneman & Tversky, 1979). When making decisions at the initiation stages of innovations, perceived risk often outweighs actual risk, as decision-makers might rely on System 1, which is influenced by biases and immediate perceptions of uncertainty, even when the objective risk is low (Kahneman, 2011). Therefore, each innovation carries a set of risks, which creates resistance to adopting it among individuals. Adopting CE practices, such as material reuse, recycling, or innovative design for deconstruction, introduces new operational, financial, regulatory, and technological uncertainties that may deviate from established conventional methods (Adabre et al., 2023; AlJaber et al., 2023; Charef et al., 2021).

Through a Systematic Literature Review (SLR), 22 risk realities for CE adoption in the construction industry were identified shown in Table 2 (Refer Findings and Discussion), and findings indicated that only a limited number of studies specifically address risk in CE adoption within construction, with most research treating risks and barriers interchangeably (Lee et al., 2023; Wuni & Abankwa, 2023). International Standard 31000: 2018 (2018, p.1) defined "*risk as the effect of uncertainty on objectives.*" Renowned risk experts Murray-Webster and Hillson (2021) defined risk as the uncertainty that matters. Accordingly, risks are uncertainties that may or may not happen but require proactive management (Murray-Webster & Hillson, 2021). Risks are dynamic and uncertain, whereas barriers are static obstacles; unresolved barriers can exacerbate risk exposure (Murray-Webster & Hillson, 2021). This study adopts the definition of risk as "uncertainty that matters" and distinguishes between risks and barriers in CE adoption. Although objective risks can be measured, individuals often perceive them differently due to presentation, cognitive biases, and emotional responses (Vasvári, 2015). Prospect Theory (Kahneman & Tversky, 1979) and related studies (Edwards, 1996) indicate that for each objective risk, decision-makers develop a corresponding risk perception, which may not align with reality. Empirical studies (Lee et al., 2023) confirm that perceived risks often accompany objective risks, but misinterpretation and lack of awareness can cause perceived risks to exceed actual risks (Vasvári, 2015). Despite this, existing research has focused primarily on identifying and measuring objective risks in CE adoption, with limited attention to how decision-makers actually perceive those risks. Understanding these perceptions is particularly critical in Australian commercial construction projects, where clients, developers, and investors play key roles in initiating and supporting CE adoption. Therefore, this study will investigate different risk perceptions that influence the initial decision-making process for adopting CE in the construction industry, particularly in the context of Australian commercial construction projects, among client-side decision makers.

3. RESEARCH METHODOLOGY

A qualitative research approach was adopted to capture the complexity, nuance, and diversity of risk perceptions among decision-makers in the Australian construction industry (Hsieh & Shannon, 2005). Unlike quantitative methods, which are suited to testing predefined hypotheses, a qualitative approach enables rich, context-specific insights into why certain risks are emphasised, contested, or dismissed. Given that CE adoption involves uncertainty, trade-offs, and judgment-based decision-making, qualitative inquiry is particularly suitable for understanding the underlying reasoning processes of clients, developers, and investors (Hsieh & Shannon, 2005). The study used semi-structured expert interviews to access the strategic and experiential knowledge of senior decision-makers in the commercial construction industry. This format balanced consistency with flexibility, allowing exploration of predefined risk categories while enabling participants to discuss issues they deemed important. The interview guide, based on CE and construction risk literature, focused on financial, regulatory, organisational, technological, and operational risks, with open-ended questions encouraging reflection on experiences and perceptions while allowing unanticipated themes to emerge. All interviews were audio-recorded with participant consent and transcribed to ensure accuracy and analytical transparency.

Purposive sampling is a nonprobability sampling technique in which researchers deliberately select participants based on specific characteristics, expertise, or knowledge relevant to the research objective (Rai & Thapa, 2015). Purposive sampling has been used because it allows the selection of experts (Tongco, 2007) with specialised knowledge and experience in CE adoption in the construction industry. These include "professionals in the client team, either internal or external professionals, such as consultants, project managers, architects, who play a central role in making decisions about adopting CE strategies in the planning stage (including feasibility and project brief) of a construction project". Their insights are crucial for understanding how risk perceptions form and how they might be managed in real project settings. Participants were selected based on having at least 15 years of industry experience and involvement in CE commercial projects in Australia, ensuring their input is grounded in practical knowledge and expertise. The sample size was followed by data saturation, and accordingly, 11 interviews were conducted. Table 1 shows the profile of the interviewees.

Table 1: Profile of interviewees

Interviewee Code	Profession Category	Organisation Type	Construction Industry Experience in Years	CE Experience in Years
I1	Sustainability Advisor	Consultant	30	10
I2	Project Manager	Client/ Developer	23	10
I3	Sustainability Advisor	Consultant	20	10
I4	Sustainability Advisor	Client/ Developer	15	3
I5	Client-Side Project Manager	Consultant	17	8
I6	Sustainability Advisor	Client/ Developer	15	5
I7	Development Manager	Client/ Developer	25	10
I8	Sustainability Manager	Consultant	20	10
I9	Sustainability Manager	Client/ Developer	16.5	7
I10	Sustainability Advisor	Client/ Developer	26	5
I11	Sustainability Advisor	Consultant	15	10

The interview data were analysed using qualitative content analysis supported by NVivo to ensure a systematic, transparent, and rigorous examination of expert explanations. An initial deductive coding framework was developed from literature-derived risk categories associated with CE adoption in construction and implemented in NVivo as parent nodes representing the identified risk perceptions. Each transcript was read iteratively and coded to determine how these risks were recognised, contextualised, and validated by Australian client-side decision-makers in commercial construction projects. Beyond identifying individual risks, a thematic co-occurrence analysis was conducted using NVivo query functions to examine how multiple risks were discussed within the same narrative segments, revealing implicit perceived interrelationships among risks. Although participants were not directly asked about risk interdependencies, this analysis enabled the identification of concurrent themes that reflect how decision-makers link risks in CE project environments. Together, content analysis and thematic co-occurrence analysis empirically validated literature-derived risks and uncovered the interconnected structure of perceived risks, providing a robust qualitative foundation for risk perceptions.

4. FINDINGS

Table 2 explains the perceived risk for client-side decision-makers in CE adoption in the Australian construction industry. The importance of a distinguished focus for perceived risk over risk reality has been emphasised by the experts; I10 stated, "*their perception of risk is really high, and probably higher than the reality of it in that sort of sense*". Experts have accepted the pre-assumptions of differences between perception and reality, as Prospect Theory (Kahneman & Tversky, 1979) explains, which are especially relevant to risks in CE adoption in the construction industry. Table 2 represents the objective risk realities identified through the SLR and accepted by the client as perceived risks in the Australian construction industry, whereas risks in *italic* letters were identified in the literature (SLR) but not accepted as perceived risks, and risks written in **bold** letters were newly identified by the client beyond the literature review.

CE projects are perceived as financially ambiguous because stakeholders are unsure whether the additional effort in reuse, recovery, and circular design will yield acceptable returns, and this is considered the main concern. I3 stated as "*cost is a big one*" in explaining the difference risk perceptions. I10 explained as "*They may not do it because they understand the old way of doing perfectly, and they understand the cost and the process in the old way of doing it. So even if they know that if they did this, they might actually save some time and, you know, material and what have you. They may not do it because they know exactly the cost and the time requirements of the previous methods or the previous materials, almost like on two fronts*". Wuni and Abnkwa (2023) explain that traditional investors or lenders may perceive circular construction as high risk due to its uncertain profitability, making it difficult to secure loans. However, experts (except I1 and I3), highlighted that uncertainty of funding strategy would not be a risk perception which will hinder the initial decision-making process, though it can be there at later stages. I1 and I3 emphasised this as a risk perception, particularly for small and medium enterprises (SMEs) and new clients in the Australian construction industry. Although the literature has identified material price fluctuations as a potential risk in construction projects, 60% of the interviewees in this study did not perceive it as a significant risk during initial decision-making for CE adoption in Australia. As I6 explained, "*Material prices can change…but that's something we can manage later; it doesn't usually stop us from moving forward in the first place.*" The remaining 40% of participants, however, noted that price volatility could pose a risk for SMEs or new entrants in the industry, who may have less capacity to absorb unexpected cost changes.

Regulatory-related risks in circular construction arise from the possibility of future policy changes rather than current regulatory gaps. While the absence of clear guidance acts as a barrier to CE adoption, uncertainty about potential changes constitutes a true risk, defined as "uncertainty that matters". Wuni and Abnkwa (2023) note that shifts in government policies or incentives may create uncertainty about whether CE-related regulations, targets, or rebates will remain stable throughout a project's lifecycle. This risk stems from potential changes, not from the current absence of incentives.

Table 2: Summary of the survey findings: perceived risks by client-side decision makers in Australian commercial construction projects

Perceived Risk of Client Side Decision Makers for CE Adoption in the Australian Construction Industry		**I 1**	**I 2**	**I 3**	**I 4**	**I 5**	**I 6**	**I 7**	**I 8**	**I 9**	**I 10**	**I 11**	**Accepted By**
Financial risks	Uncertain investment returns in circular construction projects	√	√	√	√	√	√	√	√	√	√	√	100.0%
	Uncertain funding strategies	√	x	√	x	x	x	x	x	x	x	x	18.2%
	Uncertainty in market demand for circular construction projects	√	√	√	√	√	√	x	√	√	√	√	90.9%
	Price fluctuation of circular material	√	√	x	x	√	√	x	x	x	x	√	45.5%
Regulatory risks	*Changes in government policies for circular construction projects*	x	x	x	x	x	x	x	x	x	x	x	0.0%
	Changes in incentives for circular construction projects	x	x	x	x	x	x	x	x	x	x	x	0.0%
	Regulatory compliance risk	x	√	x	x	x	x	√	x	x	x	√	27.3%
Quality Risk	Uncertainty about the performance of recycled and reused construction materials	√	√	√	√	√	√	√	√	√	√	√	100.0%
Supply chain risks	Uncertainty about the circular material supply chain for building projects	√	√	√	√	√	x	x	√	x	√	√	81.8%
	Uncertainty of sustained commitment and collaboration across the supply chain	√	x	√	√	x	x	x	√	x	√	√	54.5%
	Uncertainty of time for resolving the conflicts among circular supply chain partners	√	x	√	x	x	x	x	x	x	x	√	27.3%
Design risks	Uncertainty in End-of-life planning	√	√	√	√	√	√	√	√	√	√	√	100.0%
	Changes in Design	x	x	x	x	x	x	x	x	x	x	x	0.0%
Technological risks	Uncertainty in Performance and Reliability of Technologies	√	√	√	√	√	√	√	√	√	√	x	90.9%
	Technology integration risk	√	√	√	√	√	√	√	√	√	√	x	90.9%
Organisational risks	Strategic misalignment	√	x	x	√	x	x	√	√	x	x	√	45.5%
	Loss of Competitive Advantage	√	√	√	√	√	√	√	√	√	√	√	100.0%
Stakeholder risks	Uncertainty of the sufficiency of experts in implementing circular projects	√	√	√	√	√	√	√	√	√	√	√	100.0%
	Uncertainty of the sufficiency of skilled labour in implementing circular projects	√	√	√	√	√	√	√	√	√	√	√	100.0%
	Negative effect on employment	√	x	√	x	x	x	x	√	√	√	√	54.5%
	Corruption-associated practices	x	x	x	x	x	x	x	x	x	x	x	0.0%
Operational Risk	Longer construction time	√	x	√	√	√	√	√	√	√	√	√	90.9%
Health and safety risk	*Uncertainty of the safety of recycled construction products and materials*	x	x	x	x	x	x	x	x	x	x	x	0.0%

However, Australian experts generally did not perceive regulatory uncertainty as a significant risk in early-stage CE adoption. I4 stated "*..not really concerns, it's more like hoping …the policy side or government side, they would be more regulatory around the clarity*" while I5 stated, *"first aspect should be considered is price,"* explaining that changes in regulatory concerns do not emerge as risks in the early stages. These findings suggest that, in practice, regulatory issues are experienced less as uncertainty about policy change or incentive withdrawal, and more as ambiguity in regulatory guidance. This vagueness functions as a barrier to CE adoption and may also act as an underlying condition shaping overall risk perception, rather than constituting a discrete regulatory risk based on uncertainty. However, I2 mentioned a few regulatory compliance risks in Victoria, reflecting project-specific obligations.

Before adoption, stakeholders imagine that reused, recycled, or recovered materials may not match the reliability and consistency of virgin materials. Even in the absence of evidence, there is a perception that such materials might compromise structural integrity, durability, or aesthetics. This perceived quality uncertainty affects confidence at the decision stage, as construction decision-makers are highly risk-averse to quality. However, I4 noted that at the building level, quality concerns focus mainly on high-cost structural materials such as concrete and reinforcing steel, whereas highly recyclable materials, such as steel, are perceived as low-risk. I7 raised a lesser weightage in describing the impact of quality risk in perception, "*Not normally that early…not normally until you get a bit deeper into it*". However, I7 still explained that if reuse and refurbishment are the CE initiative, the quality aspect is a main risk factor that will eventually become a risk perception.

The findings indicate that client-side decision-makers in circular construction perceive supply chain-related uncertainties at varying levels. Inconsistencies in the supply chain for materials and services emerged, suggesting strong stakeholder concern about procurement reliability in circular supply systems. I6 explained it as after thinking about what is needed, how it can be attained will be a concern, which shapes the perception as "*need to have access to those solutions, which becomes a little bit more of a supply chain. Is it available, commercially available in the supply chain?*. Relational and coordination-related issues, including the absence of long-term partnerships, inconsistent stakeholder engagement, and communication gaps, were suggested by 50% of experts, reflecting concerns about collaborative stability but with comparatively lower intensity. Conflicts among diverse circular supply chain actors were perceived at a substantially lower level (20%), indicating that although governance tensions are acknowledged, they are not uniformly regarded as a critical perceived threat at the initial stages of decision making

Changes in design were rejected by all interviewees as a CE-specific risk, as design changes were viewed as a common and inherent feature of construction projects rather than a distinctive challenge introduced by circular practices. In contrast, end-of-life planning was perceived as a salient risk, as it introduces new considerations related to future adaptability, disassembly, and material recovery that are not typically embedded in conventional project decision-making.

Uncertainty in the performance and reliability of circular construction technologies increases risk perception because decision-makers in the construction industry are typically risk-averse and rely heavily on proven, long-term performance data (Tam, 2024; Tan et al., 2022). I1 explained that "*technological advancement is definitely part of the* *decision, but it's often seen through a time and risk lens, rather than just innovation*". Adding to this, I6 stated that, as well as the client may perceive it as a risk, while contractors and the suppliers will consider technological advancement related to CE adoption such as digital material banks or building asset tracking systems (i.e., digital logs of building components and documentation), as an opportunity.

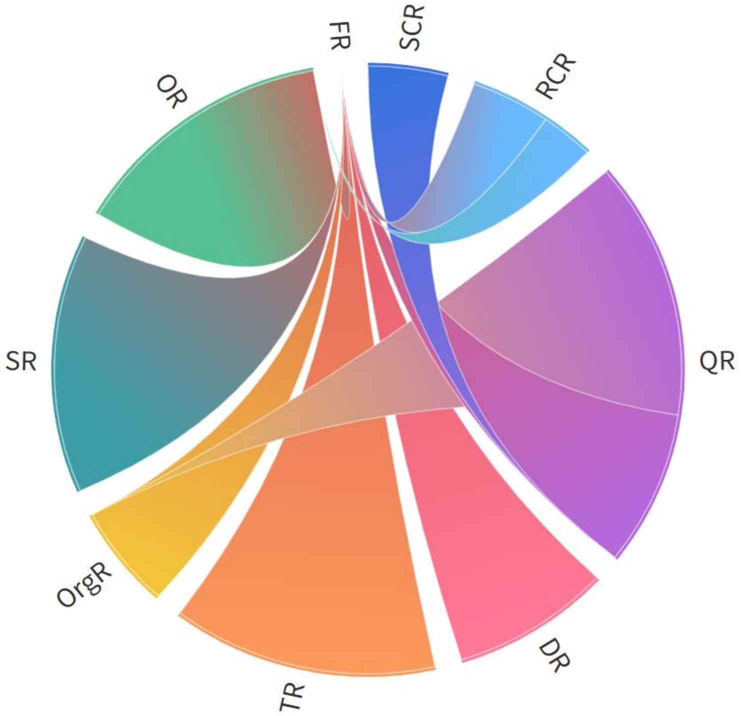
Organisations may perceive CE adoption as potentially misaligned with their current business strategy. There is a perception that focusing on circular practices might divert attention from core operations or reduce short-term competitiveness. Decision-makers fear that investing in CE may not align with market expectations or could disadvantage the organisation if competitors do not follow similar practices. This perceived strategic misfit delays initial commitment. I1 stated it as "*because people feel like, if something, if they do take a risk on a new product, for example, and it goes wrong, it'll be their reputation on the line. So I think reputational thing, and certainly the biggest challenge*," I10 added, "*not just the costs of the business, but also the reputation of the business as well.*"

There is a perception that CE projects require specialised knowledge and skills that may not be readily available. Decision-makers fear difficulty in finding experts, trained labour, or consultants who understand circular construction. I5 illustrated that there is a risk of availability, and approaching required experts and skilled workforce will influence the initial decision-making process; "*You should be able to find qualified people, who know? Yeah, who knows how to deal with this equipment, how to adjust it, what parameters should be, how it should be, what should not be*" The uncertainty of negative impact on the existing employment, which was identified as a risk by Wuni and Abnkwa (2023) has gained 50% acceptance as a possible risk perception, as I3 explained that CE adoption can create new employment opportunities, but certain professions may face reduced demand, particularly affecting local or regional economies, requiring a just transition. However, the other 50% has not accepted it as a risk, stating, I8, "*it's not necessarily a risk in the sense of lack of jobs, it's just a shift of practices and behaviour".* Furthermore, Hassan et al. (2023) identified corrupt practices as a potential risk to the adoption of CE strategies in the Pakistani construction industry. However, the interviewees in this study did not consider future corruption as a perceived risk during initial decision-making regarding CE adoption in the Australian construction industry.

I1 illustrated adopting a circular solution means new or unfamiliar technology, learning new systems, or relying on untested tools, then decision makers immediately think about extra time, extra coordination, and potential delays. Accordingly, longer operational time is considered a key risk perception among client-side decision-makers in the Australian commercial construction industry. However, I9 added "*it definitely takes more time, and you have to be doing it for a reason"* while emphasising that "*prefabrication, or modular construction, which actually does reduce the time being few strategies in circular economy adoption*".

Experts indicated that health and safety issues were not perceived as a determining risk when deciding whether to pursue CE strategies, as these concerns typically arise later during detailed design, specification, or construction phases. As one interviewee (I9) explained, "*Not really, no, at least not in the initial decision-making. Health and safety around secondary materials might come up later in the process, once you're actually getting into specifications or construction. But at the early stages, when decisions about* *whether to pursue circular options are being made, it's not seen as a major risk*." This suggests that health and safety considerations do not significantly drive or impede early CE adoption decisions, with respondents instead prioritising risks related to cost, market demand, and delivery certainty.

Experts explained the interdependencies among some risk perceptions as shown in Figure 1. Experts emphasised that these marked interdependencies always trigger the other risk perception. The perceived financial risk is influenced by most of the other risk perceptions. As an example, I3 "*If something has an impact on… the time frame… that has an impact on construction costs*" as a longer construction time, which is perceived as a risk in the early decision-making process by the experts. When I2, I7 and I11 emphasise the regulatory compliance risks, their impact on the project cost and time frame has also been stated. Though it has not been separately questioned, every expert has highlighted that financial risk often becomes the central outcome, as design changes, technological uncertainty, organisational capability gaps, stakeholder misalignment, operational inefficiencies, and quality issues ultimately translate into cost overruns or budget uncertainty.



FR – Financial Risk, RCR – Regulatory Compliance Risk, SCR – Supply Chain Risk, QR – Quality Riks, SR – Stakeholder Risk, TR – Technological Risk, DR – Design Risk, OrgR – Organisational Risk, OR – Operational Risk

Figure 1: Interdependencies of perceived risks through thematic concurrence analysis

Furthermore, the expert highlighted that quality risk is often closely linked to organisational reputation, noting that "*if they do take a risk on a new product, for example, and it goes wrong, it'll be their reputation on the line*" (I1), which can directly lead to a loss of competitive advantage, which shapes the initial risk perception. Quality of materials and supply chain-related risks are likely discussed by the experts as issues in the supply chain, such as unreliable suppliers, delayed deliveries, or substandard materials, that directly threaten the quality of the final product. I11 emphasised that this quality-related risk perception would not only represent a quality failure but could also escalate into regulatory non-compliance risk perception and reputational damage, which leads risk perception around to the loss of competitive advantage, which was categorised under organisational risk.

The findings from this study highlight that perceived risks, rather than objective risks, predominantly shape early decision-making in CE adoption within the Australian commercial construction sector. In practice, these findings suggest that decision-makers approach CE adoption cautiously, with perceived risks shaping the threshold for initial commitment, even when objective risks may be lower or manageable.

5. DISCUSSION

The study confirms the importance of focusing on perceived risk rather than risk reality, as it influences the risk aversion of client-side decision-makers in the early stages of adopting CE in construction projects, as also emphasised by Tan et al. (2022) and Kazancoglu (2020) in other industries. Similar to prior studies on risk realities (Hassan et al., 2023; Tam, 2024; Wuni & Abnkwa, 2023), financial uncertainty, quality concerns, supply chain instability, technological uncertainty, and capability-related risks emerged as dominant perceived risks influencing early-stage CE adoption decisions. The findings reinforce that client-side decision-makers prioritise cost certainty, delivery reliability, and reputational outcomes at early decision stages (Berglund-Brown et al., 2024; Bertassini et al., 2021). This reflects the Australian commercial construction context, which is shaped by structured procurement systems, developer-led financing, and performance-driven contracts (Rahmani et al., 2016). In cities such as Melbourne and Sydney, investment expectations further emphasise predictable delivery, stable leasing outcomes, and return-on-investment requirements (Ellison et al., 2026). As a result, stakeholders prioritise cost certainty, programme reliability, and proven material performance in feasibility assessments. Nevertheless, as circular supply systems and secondary markets in Australia remain relatively immature and less integrated than conventional construction supply chains, CE adoption is often viewed as carrying higher uncertainty than linear approaches (Commonwealth Scientific and Industrial Research Organisation, 2024; Feldman et al., 2024). On the other hand, previous studies often frame regulatory uncertainty, policy instability, health and safety concerns, corruption-associated practices, and design changes as CE-related risks (Hassan et al., 2023; Tam, 2024; Wuni & Abnkwa, 2023). In contrast, these factors were not perceived as major risks during the initial decision-making stage in Australia. Instead, regulatory issues were interpreted more as barriers arising from unclear guidance rather than uncertainty regarding future policy changes. Similarly, design changes were viewed as inherent characteristics of construction projects rather than CE-specific risks. Corruption-related concerns, which are emphasised in studies conducted in developing economies (Hassan et al., 2023), were not identified as a risk factor influencing initial decision-making. Australia's comparatively stable governance system, mature regulatory environment, and established construction standards may explain why corruption and regulatory instability were not strongly perceived as risks at the initial stages of the decision-making process (Iyer-Raniga et al., 2023). Instead, participants were more concerned with practical implementation uncertainties, particularly those affecting project feasibility, quality assurance, and competitive positioning. These exceptions suggest that risk perceptions are highly context-dependent and shaped by institutional maturity, governance quality, and industry culture, as explained in the Psychometric paradigm (Slovic, 1987), Cultural theory of risks (Douglas & Wildavsky, 1982) and Prospect theory (Kahneman & Tversky, 1979).

Although this study is based on the Australian commercial construction sector, the findings may be cautiously applicable to other developed construction industries undergoing CE transition, particularly where regulatory systems, procurement practices, and project delivery structures are similar (Iyer-Raniga et al., 2023). Similar patterns have also been identified in other industries. For example, Kazancoglu et al. (2020) found that CE adoption decisions in the e-waste sector were influenced by concerns regarding financial, reputational, and material-related uncertainty, consistent with Prospect Theory (Kahneman & Tversky, 1979). Similar concerns were evident in this study, indicating that risk perceptions associated with CE adoption may extend beyond industry boundaries where circular practices challenge conventional operational systems and established decision-making routines (Tan et al., 2022). Nevertheless, the applicability of these findings should be considered with caution, as the nature and intensity of perceived risks are likely to differ across regions depending on institutional stability, market maturity, technological capability, and the cultural acceptance of innovation and sustainability practices (Douglas & Wildavsky, 1982; Kahneman & Tversky, 1979; Tan et al, 2022).

6. CONCLUSIONS

This study underscores the importance of distinguishing between perceived and objective risks in the adoption of circular economy strategies within the construction industry. Through interviews with client-side decision-makers in the Australian commercial construction sector, it was observed that perceived financial risk dominates the adoption calculus, strongly influenced by interlinked perceptions of material quality, design complexity, stakeholder capability, and operational time. Conversely, risks commonly cited in literature, such as regulatory uncertainty, health and safety concerns, and corruption, were either minimally perceived or deferred to later project stages. These insights highlight that misalignment between perceived and objective risks can impede initial CE adoption, particularly for SMEs and projects with limited experience in circular practices. Addressing these perception-driven barriers will reframe CE adoption as a strategic opportunity rather than a speculative threat, ultimately supporting broader and more confident implementation of circular construction practices. Therefore, this study will extend to identify the causes of those risk perceptions among client-side decision-makers in Australian commercial construction projects and thereby provide actionable strategies to manage them. The study is limited by its small purposive sample of 11 client-side experts, which, although sufficient to achieve data saturation, may reduce the generalisability of findings to broader contexts. The study focuses exclusively on client-side decision-makers, excluding contractors, suppliers, regulators, or end-users, whose risk perceptions could differ and influence CE adoption decisions.

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