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RESEARCH ARTICLE

Aligning Digital-Circular Capabilities and Institutional Pressure in Construction: A Strategic Framework for Circular Economy Transformation

Fredrik Lindblad[1*]

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Abstract

Digital circular transformation requires alignment between organisational capabilities and institutional conditions. This article introduces the DCAM Strategic Positioning Matrix (SPM), integrating the Resource-Based View and institutional theory to explain variation in circular outcomes. The framework maps organisations along two dimensions, internal digital-circular capability and external institutional pressure, yielding four configurations: Minimal Effort, At-Risk, Innovation Buffer, and Ready-to-Scale. Empirical analysis of Nordic wood construction firms (N = 223) reveals a strongly asymmetric distribution, with firms concentrated in high-capability quadrants (86.5% Ready-to-Scale, 13.5% Innovation Buffer). Consequently, digital-circular capabilities function as mature baselines, whereas institutional pressures shape their translation into circular outcomes. Regression analyses show additive effects (capability: $\beta = 0.420$, $p = .003$; pressure: $\beta = 1.136$, $p < .001$) without multiplicative interaction, suggesting parallel rather than synergistic mechanisms. The study contributes by (1) identifying a boundary condition for capability-based theory: when digital-circular capabilities reach sectoral saturation, institutional pressure becomes the primary driver of outcome heterogeneity, shifting the focus from capability development to capability activation; (2) operationalizing this boundary condition through a configurational alignment framework that makes capability–context fit analytically explicit; and (3) providing a replicable diagnostic tool for strategic positioning in circular transformation contexts. Consequently, in mature settings, circular economy acceleration appears to depend more on strengthening institutional pressure than on further capability development, shifting policy focus from supporting adoption to activating existing capabilities at scale.

Keywords Circular Economy · Strategic Positioning · Digital Transformation · Institutional Theory · Resource-based View · Construction · Alignment · Capabilities

1. Introduction

The transition toward a circular economy reveals a strategic paradox. While organisations increasingly develop digital infrastructures and circular capabilities (Lindblad, 2026a), a significant asymmetry exists between these capabilities and the institutional conditions required for their activation (Kristoffersen et al., 2020; Oliver, 1997). Digital capabilities alone do not guarantee transformation; they generate value only when regulatory frameworks, market demand, and ecosystem infrastructure create deployment incentives. In digitally mature sectors, this dynamic shifts the basis of competitive differentiation from internal readiness toward institutional alignment mechanisms.

The construction industry exemplifies this challenge. Digital technologies such as Building Information Modelling (BIM), IoT, digital twins, artificial intelligence, and digital product passports are widely recognized

[*] Corresponding author: fredrik.lindblad@lnu.se
[1] School of Business and Economics, Department of Management, Linnaeus University, Växjö, Sweden

as key enablers of circular practices, supporting material traceability and lifecycle management (Charef & Emmitt, 2021; Celik et al., 2023; van Capelleveen et al., 2023; Banihashemi et al., 2024). However, recent reviews highlight persistent implementation gaps and fragmented adoption (Çetin et al., 2022; Celik et al., 2023; Keles et al., 2025; Cruz Rios et al., 2021; Hjaltadóttir & Hild, 2021). Organisations frequently possess elements of digital infrastructure and circular design knowledge yet struggle to translate these into scalable circular business practices. This misalignment problem is central to understanding why many firms report pilot initiatives and scattered circular practices, yet achieve limited system-level transformation (Lindblad & Gustafsson, 2026). The empirical illustration focuses on Nordic wood construction, a relatively advanced context in terms of digitalization and circular policy frameworks; accordingly, the findings are most directly applicable to mature, high-capability settings and should be interpreted with caution in early-stage circular contexts.

Addressing this requires bridging theoretical perspectives that current frameworks largely treat separately. Recent research on circular economy transformation has emphasized digital technologies and ecosystem coordination (Geissdoerfer et al., 2017; Bressanelli et al., 2018), while sustainability transitions literature highlights institutional pressures and regulatory frameworks (Geels, 2011; Köhler et al., 2019). However, much of this work examines technological capabilities and institutional drivers independently, with limited attention to their joint effects. Traditional positioning frameworks treat environmental issues peripherally (Porter, 1980), while maturity models focus on internal readiness with limited guidance on institutional pressures (Uhrenholt et al., 2022; Seles et al., 2022). Bridging the Resource-Based View (Barney, 1991; Hart, 1995) and institutional theory (Scott, 2014) is therefore necessary to explain how internal capabilities and external pressures jointly drive circular advantage.

This article addresses this gap by introducing the DCAM Strategic Positioning Matrix (SPM), a two-dimensional analytical framework that maps organisations according to their internal digital-circular capabilities and the external institutional-market pressure they face. The SPM integrates RBV and dynamic capabilities theory with institutional theory to generate four strategic quadrants: Minimal Effort (low capability, low pressure), At-Risk (low capability, high pressure), Innovation Buffer (high capability, low pressure), and Ready-to-Scale (high capability, high pressure). Each quadrant represents a distinct alignment scenario with specific strategic imperatives, risk profiles, and pathways for capability development. The article therefore extends the RBV by conceptualizing digital–circular capabilities as context-dependent strategic resources whose value arises not from technological possession alone, but from their alignment with external institutional pressures and ecosystem expectations (Bag et al., 2021).

1.1. Research Questions

Integrating RBV and institutional theory motivates three research questions guiding the empirical analysis and discussion:

- **RQ1:** How do organisations distribute across configurations combining internal digital-circular capability and external institutional pressure, and what explains observed distributional patterns?
- **RQ2:** To what extent do internal capabilities and external institutional pressures, individually and jointly, predict perceived circular performance outcomes?
- **RQ3:** What strategic implications follow for organisations in the observed high-capability configurations, and what does the unoccupied low-capability space imply for boundary conditions and future tests of the framework?

This article makes three targeted contributions that advance beyond prior RBV–institutional integrations (Oliver, 1997; Hart & Dowell, 2011). First, it identifies and theorizes a specific boundary condition for capability-based theory: when digital-circular capabilities reach structural saturation across a sector, institutional pressure becomes the primary driver of outcome heterogeneity, shifting the theoretical focus from capability development to capability activation. Second, it operationalizes alignment as configurational positioning through the SPM's mapping, making boundary conditions analytically explicit rather than relying solely on multiplicative interaction terms. Third, it demonstrates the empirical applicability of this configurational approach using Nordic wood construction data, providing a replicable diagnostic framework for strategic positioning analysis.

2. Theoretical Foundation

2.1. Internal Capabilities for Circularity: Resource-Based View and Dynamic Capabilities

Internal digital–circular capability refers to the organisational resources and competences that enable firms to implement and scale digital and circular strategies, forming the horizontal axis of the DCAM SPM. This dimension is grounded in the RBV, which posits that sustained advantage derives from valuable, rare, inimitable, and non-substitutable (VRIN) resource bundles (Barney, 1991). In circular economy contexts, such "circular capital" includes both tangible assets, such as digital infrastructures, modular product architectures, and reverse logistics systems, and intangible resources, including domain-specific knowledge, data governance, and organisational cultures supporting circular value creation (Hart, 1995; Hart & Dowell, 2011; Geissdoerfer et al., 2017; Lieder & Rashid, 2016). In this study, "capability" is operationalised as organisational readiness/maturity for digital circular deployment (not as a direct measure of VRIN rarity). This allows us to examine when broadly available capabilities still produce heterogeneous outcomes because activation conditions differ.

Dynamic capabilities theory (Teece et al., 1997; Teece, 2018) complements RBV by enabling organisations to sense opportunities, seize strategic investments, and reconfigure resources to embed circular practices. This translates digital infrastructures and circular design knowledge into scalable circular business models.

Consistent with the DCAM framework, internal digital–circular capability is conceptualised as a multidimensional construct comprising four interrelated domains:

1. Foundational digital resources, including interoperable BIM, IoT monitoring, AI analytics, and data governance for lifecycle transparency (Kristoffersen et al., 2020; Celik et al., 2023).
2. Circular design and process capabilities, encompassing design for disassembly, modular construction, adaptive reuse, and circular procurement practices (Eberhardt et al., 2022; Akanbi et al., 2018).
3. Circular business model capabilities, including product–service systems, leasing models, secondary material markets, and reverse logistics configurations (Bressanelli et al., 2018; Ghafoor et al., 2023).
4. Organisational and relational enablers, reflecting leadership commitment, cross-functional integration, circular competencies, and inter-organisational collaboration (Dyer & Singh, 1998; Seles et al., 2022).

High internal capability reflects the organisation's ability to orchestrate these domains into coherent capability configurations, whereas low capability indicates fragmented or underdeveloped resource integration.

2.2. External Pressures and Institutional Drivers: Institutional Theory and Socio-Technical Transitions

External pressure for circularity refers to the institutional and market forces that encourage or require organisations to adopt circular practices. Within the SPM framework, this constitutes the vertical axis. Drawing on institutional theory and the Multi-Level Perspective, it explains how coercive, normative, and cultural forces shape organisational behaviour and sectoral change (Geels, 2011; Scott, 2014). Emerging traceability requirements, including digital product passport initiatives, can operationalize pressure by making circular documentation auditable and market-relevant rather than voluntary (Zhang & Seuring, 2024; Ruismäki et al., 2025).

Classical institutional theory distinguishes three forms of institutional pressure (DiMaggio & Powell, 1983; Scott, 2014):

- Coercive: Formal regulations and mandates, such as extended producer responsibility laws, waste recovery requirements, and digital documentation mandates (Hjaltadóttir & Hild, 2021).
- Normative: Professional standards, cultural expectations, and stakeholder demand, for example, architects specifying circular performance criteria or investors including circularity metrics in ESG evaluations (Cruz Rios et al., 2021).

- Mimetic: Imitation of perceived successful peers under uncertainty, particularly as circular business cases become visible and competitors adopt similar practices.

Institutional pressure is treated as time-varying (regulation, market demand, and ecosystem infrastructure), which implies that firms may move across SPM positions as external conditions evolve (Geels, 2011; Ranta et al., 2018).

Having established the internal capability and external pressure dimensions, we now examine their joint theoretical interpretation within a contextualized RBV-institutional perspective. This implies that the strategic value of digital–circular capabilities depends on their alignment with external institutional conditions. In construction, firms often possess emerging capabilities but remain constrained by weak market demand and regulatory fragmentation (Lindblad & Gustafsson, 2026). Even VRIN capabilities yield limited advantage without supportive institutional infrastructure (Oliver, 1997), while institutional pressure alone fails without corresponding internal capabilities (Hart & Dowell, 2011).

Building on this logic, the SPM conceptualizes alignment as configurational rather than purely statistical (Venkatraman, 1989). Following neo-configurational perspectives (Furnari et al., 2021; Misangyi et al., 2017), alignment is reflected in (1) configurational patterning across capability–pressure quadrants and (2) joint additive effects on outcomes. Consequently, a non-significant multiplicative interaction does not falsify alignment; rather, it may indicate that capabilities and institutional pressures operate through complementary independent mechanisms, particularly when limited variance in one dimension constrains statistical detectability (Aguinis et al., 2017).

The SPM thus reframes digital circular transformation from technological adoption (Vial, 2019) to strategic alignment, where capabilities enable action while institutional conditions shape their value (Bag et al., 2021). Accordingly, the DCAM SPM operationalizes this capability–context fit as a diagnostic positioning tool. These boundary conditions are shaped by variation in capability levels.

3. The DCAM Strategic Positioning Matrix

3.1. Conceptual Logic and Strategic Configurations

The DCAM SPM functions as both a theoretical contribution and a practical diagnostic instrument. Theoretically, it advances strategic alignment research by operationalizing capability–context fit as configurational positioning rather than statistical interaction, thereby making boundary conditions analytically visible. Practically, it enables organisations and policymakers to assess their current strategic position and prioritize interventions based on their configuration.

The SPM, shown in Figure 1, positions organisations along two dimensions: internal digital–circular capability (x-axis) and external institutional–market pressure (y-axis). Internal capability reflects the organisation's ability to deploy digital technologies, circular design practices, and coordination mechanisms for circular value creation, while external pressure captures regulatory, market, and normative forces shaping circular adoption.

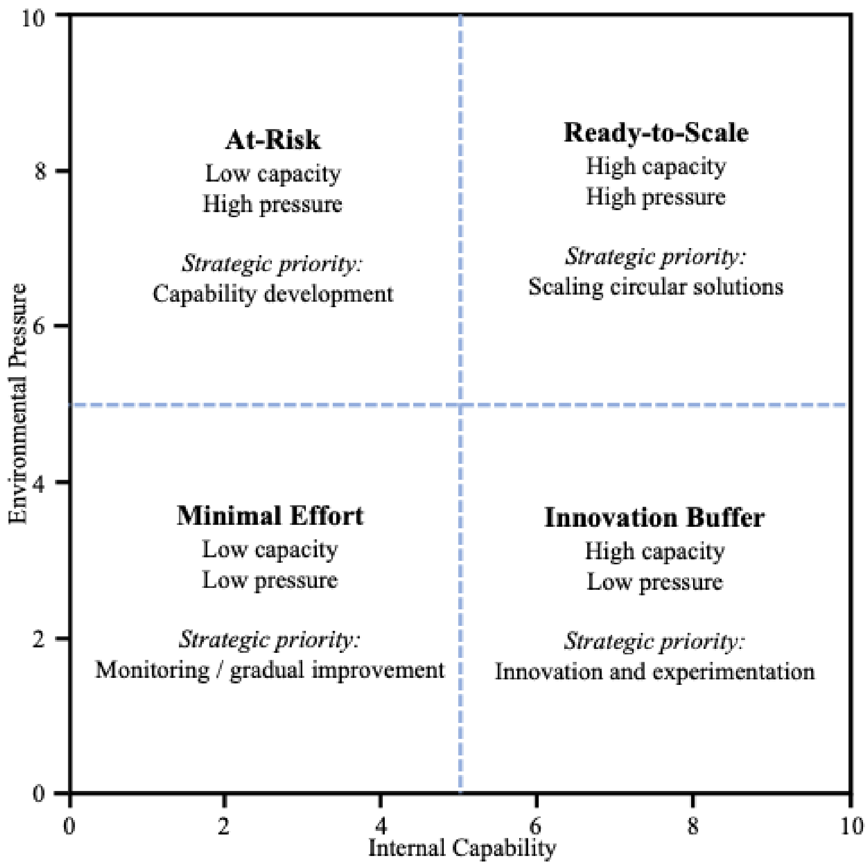

Figure 1. DCAM Strategic Alignment Matrix

Crossing these dimensions yields four configurations, Minimal Effort, At-Risk, Innovation Buffer, and Ready-to-Scale, consistent with established two-by-two strategic alignment logics (Weihrich, 1982). Each configuration implies a distinct risk profile and strategic priority.

3.1.1. Minimal Effort (low capability – low pressure) Circular initiatives remain exploratory or symbolic, with limited integration into core business models (Kirchherr et al., 2018). Strategic attention is primarily directed toward monitoring institutional developments while maintaining efficiency in existing linear operations.

3.1.2. At-Risk (low capability – high pressure) This misalignment creates compliance risks and operational vulnerabilities (Castro-Lopez et al., 2023; Cruz Rios et al., 2021) and necessitates rapid capability mobilization through partnerships or internal development.

3.1.3. Innovation Buffer (high capability – low pressure) These capabilities are often deployed in experimentation and pilot projects and may function as strategic options for future scaling (Bressanelli et al., 2018; Teece, 2018).

3.1.4. Ready-to-Scale (high capability – high pressure) This alignment creates favourable conditions for scaling circular business models and coordinating ecosystem actors (Dyer & Singh, 1998; Ghafoor et al., 2023; Bressanelli et al., 2018), enabling more advanced forms of circular value creation, including product-service systems.

3.2. Transformation Pathways

Although the DCAM SPM identifies four configurations, digital circular transformation is inherently dynamic, with organisations moving between positions as capabilities evolve and institutional conditions change (Rashidian et al., 2025). Organisations in At-Risk may progress toward Ready-to-Scale by developing digital infrastructure, circular capabilities, and ecosystem partnerships (Teece et al., 1997; Teece, 2018). Firms in Innovation Buffer possess advanced capabilities but depend on strengthening institutional pressures to unlock scaling advantages, while those in Minimal Effort risk moving toward At-Risk under increasing external pressure without corresponding capability development (Geels, 2011; Köhler et al., 2019). The SPM thus serves as both a diagnostic tool and a dynamic framework for guiding capability development and institutional alignment.

4. Methodology

4.1. Research Design

This study employs a cross-sectional survey combined with configurational and regression analyses to examine how alignment between internal digital–circular capabilities and external institutional pressure relates to circular performance outcomes. Consistent with strategic fit research, outcomes are modelled as emerging from the interaction between internal and external dimensions (Venkatraman, 1989; Edwards & Parry, 1993). The analysis provides a theory-informed empirical test of the SPM framework. The sample is concentrated in high-capability configurations, which constrains validation of the SPM's full configurational logic and limits generalizability to mature contexts.

4.2. Data Collection and Sample

Data were collected through a structured survey targeting organisations across the Nordic wood construction ecosystem, including architects, contractors, engineering firms, developers, and material suppliers. This ecosystem-based sampling captures heterogeneity in capabilities and institutional exposure across the value chain.

The survey instrument was developed based on the DCAM framework and prior literature on digitalization, circular economy, and institutional pressures. Content validity was ensured through an iterative process combining literature review, expert consultation, and pilot testing with academic and industry stakeholders (Podsakoff et al., 2003).

Responses were measured on a 10-point Likert scale, consistent with prior CE studies using perceptual measures. The final dataset comprises 223 organisations. While the sampling enables broad ecosystem coverage, it likely overrepresents organisations active in industry networks and circular economy initiatives. This network-based sampling likely contributes to the observed high capability floor and may explain the complete absence of low-capability firms in our sample. Organisations disengaged from sustainability networks or in early stages of digital-circular development are likely underrepresented, which limits generalizability to the broader construction sector population. Survey items are provided in Appendix A.

4.3. Measurement and Construct Operationalization

Building on the DCAM framework (Lindblad, 2026a), the SPM operationalization aggregates capability domains into a strategic positioning construct within a two-dimensional analytical space.

Internal digital–circular capability was specified as a formative construct comprising digital infrastructure, circular design and processes, business model capabilities, and organisational enablers (Jarvis et al., 2003; Coltman et al., 2008), aggregated into a composite index reflecting overall capability deployment. Conversely, external institutional pressure was modelled as a reflective construct capturing coercive, normative, and market-based drivers, demonstrating strong internal consistency (Cronbach's $\alpha = 0.88$).

Circular performance combined five perceptual indicators—material circularity, waste reduction, lifespan extension, strategic confidence, and overall progress—into a transformation outcome index. Robustness checks using alternative specifications yielded consistent results, with no multicollinearity concerns (VIF < 2.5), supporting the measurement approach within the SPM framework.

4.4. Index Construction and Classification

Composite indices were standardised using z-scores to enable comparability and to position organisations within the two-dimensional SPM framework, with internal capability and external pressure represented along orthogonal axes. Organisations were assigned to SPM quadrants using the theoretical scale midpoint (5.0) as a low–high capability/pressure threshold, complemented by median splits to ensure robustness. The 10-point scale was anchored with endpoints, and pilot testing (n = 34) indicated that scores below 5 were perceived as insufficient for circular implementation. Alternative specifications (median and percentile splits) did not alter the strongly asymmetric distribution, supporting the robustness of the classification. In addition to categorical classification, analyses were conducted using continuous capability–pressure measures, enabling a more fine-grained assessment of alignment effects and positioning patterns.

4.5. Analytical Strategy

The empirical analysis combines configurational and regression-based approaches to examine both distributional patterns and alignment effects. Descriptive analyses assess the distribution of organisations across SPM configurations, while independent-sample comparisons evaluate differences between configurations. OLS regression models estimate the additive effects of capability and institutional pressure on circular performance outcomes.

To examine alignment effects, polynomial regression and response surface analysis are applied, enabling a continuous assessment of congruence and misalignment between internal capability and external pressure, consistent with prior research on strategic fit. Following response-surface conventions, predictors were mean-centred before creating squared and interaction terms, and surface tests along the congruence (I_cap = E_pres) and incongruence (I_cap = −E_pres) lines are reported (Edwards & Parry, 1993).

4.6. Validity and Robustness Considerations

Construct validity was ensured through theory-driven item development, expert consultation, and pilot testing, alongside appropriate specification of formative and reflective models (Jarvis et al., 2003). Robustness and convergent validity were assessed through sensitivity analyses and external performance indicators, complemented by stakeholder feedback.

Common method bias was mitigated procedurally and assessed via Harman's single-factor test (34.2% variance explained), suggesting severe bias is unlikely (Podsakoff et al., 2003), although it cannot be fully ruled out in a single-source, cross-sectional design. The cross-sectional design limits causal inference; findings remain associational and future research should incorporate multi-source data.

5. Empirical Illustration of the Strategic Positioning Matrix

The empirical analysis examines how organisations position themselves within the SPM and how these positions relate to perceived circular performance. Building on the integration of RBV and institutional theory, the SPM conceptualizes circular transformation as an alignment challenge between internal digital–circular capabilities and external institutional pressures. Accordingly, the analysis explores how organisations are distributed across the capability–pressure space and how these positions relate to reported circular outcomes.

5.1. Descriptive Overview

Internal capability shows limited dispersion (SD = 0.31) relative to external pressure (SD = 1.07), indicating a mature capability baseline and more heterogeneous institutional conditions (Table 1). This asymmetry suggests that capability development has reached a relatively mature baseline, while the activation of these capabilities remains contingent on uneven institutional pressures. This pattern aligns with prior findings highlighting that external structural barriers, rather than capability deficits, increasingly explain variation in circular implementation outcomes in construction contexts (Lindblad & Gustafsson, 2026).

Variation is particularly visible in the business model dimension, which shows greater dispersion than infrastructure and strategy capabilities. This suggests the presence of a capability-to-scaling gap in which digital infrastructure and circular design knowledge are relatively established, while the translation of these capabilities into circular business models remains more uneven.

Table 1. Descriptive Statistics for the main constructs within the DCAM (N = 223)

Construct	Mean	SD	Min	Max
Digital Infrastructure	6.94	0.52	5.43	8.14
Circular Strategies	6.69	0.40	5.38	7.62
Business Models	6.20	0.82	3.80	9.00
Organisational Capabilities	6.47	0.64	4.50	8.00
Internal Capability (I_cap)	6.57	0.31	5.67	7.47
External Pressure (E_pres)	6.08	1.07	3.50	8.38

5.2. Configurational Positioning

To illustrate the strategic positioning logic of the SPM, organisations were classified using the theoretical midpoint (5) of the 10-point scale, reflecting the conceptual structure of the framework rather than a sample-relative split. The empirical distribution across quadrants is presented in Table 2.

Table 2. Distribution Across SPM Quadrants

Quadrant	n	%
Minimal Effort (Low/Low)	0	0
At-Risk (Low/High)	0	0
Innovation Buffer (High/Low)	30	13.5
Ready-to-Scale (High/High)	193	86.5

The distribution is strongly asymmetric, with all organisations exceeding the capability threshold. As a result, the framework is empirically concentrated in the two high-capability configurations: Ready-to-Scale (86.5%) and Innovation Buffer (13.5%) (Table 2). No observations appear in the Minimal Effort or At-Risk quadrants, suggesting that variation in strategic positioning appears to be largely associated with differences in institutional pressure.

This pattern reflects a structurally mature context in which digital–circular capabilities function as baseline conditions rather than sources of differentiation. Under such conditions, the observable configurational range of the SPM becomes constrained, highlighting an important boundary condition of the framework that is likely to be more fully observable in contexts characterized by greater heterogeneity in capability development.

This asymmetric distribution has important implications for interpreting our empirical findings. The SPM's full configurational logic, including the theoretical predictions for Minimal Effort and At-Risk quadrants, cannot be validated within this sample. Our empirical claims are therefore bounded to high-capability configurations and should not be interpreted as confirming the complete framework. The theoretical logic for low-capability contexts remains to be tested in samples with greater capability heterogeneity.

Figure 2 visualizes the distribution of organisations across the capability–pressure space of the SPM.

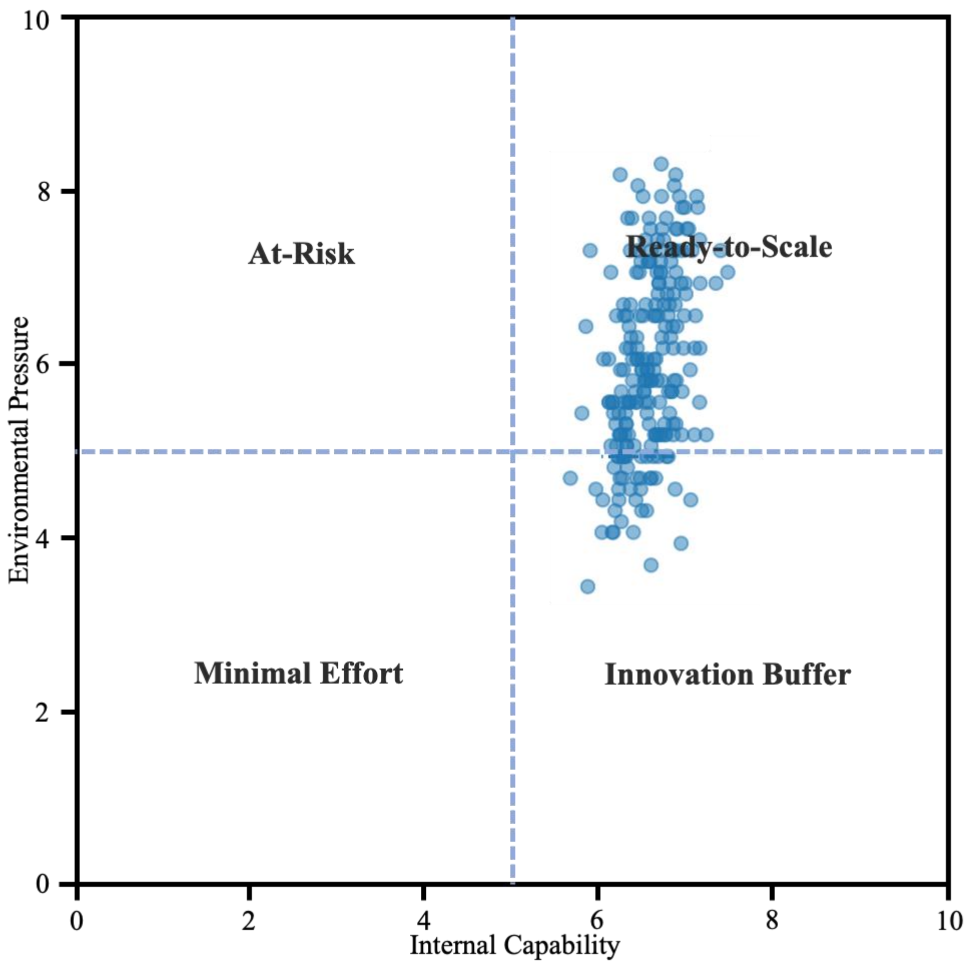

Figure 2. Strategic positioning of firms within the SPM framework.

The absence of observations in the Minimal Effort and At-Risk quadrants suggests that baseline digital–circular capabilities are widely established in the Nordic wood construction ecosystem (Banihashemi et al., 2024; Keles et al., 2025). In such contexts, capabilities may function as necessary conditions rather than sources of differentiation, whereas in less mature contexts capability variation is likely to remain a primary driver of strategic positioning.

This interpretation is consistent with evidence from less mature contexts, where substantially greater dispersion in digital–circular capability has been observed, suggesting that the full configurational range of the SPM becomes empirically visible under different institutional and developmental conditions (Lindblad & Gustafsson, 2025).

Strategic variation instead appears to derive primarily from institutional positioning. The limited performance difference between configurations (0.25 points, $p = .407$) and the stronger effect of institutional pressure ($\beta = 1.136$) relative to capability ($\beta = 0.420$) indicate that external conditions play a key role in activating capabilities in mature settings.

5.3. Outcome Differentiation

Because the empirical distribution contains observations in only two configurations, outcome differences were examined between the Innovation Buffer and Ready-to-Scale groups.

Table 3. Outcomes by Quadrant

Quadrant	Mean	SD
Minimal Effort	0	0
At-Risk	0	0
Innovation Buffer	6.36	0.31
Ready-to-Scale	6.61	0.30

Ready-to-Scale organisations reported marginally higher outcomes than Innovation Buffer firms, though this difference was not statistically significant (Table 3).

5.4. Continuous Capability–Pressure Relationships

To further explore the relationships between capability, institutional pressure, and circular outcomes, regression analyses were conducted using continuous measures of the SPM dimensions. Both internal capability and external pressure show positive and statistically significant associations with perceived circular outcomes, suggesting that each dimension contributes independently to performance variation. However, the interaction term between capability and pressure is not statistically significant in a linear specification, indicating that the relationship between these dimensions may not be adequately captured through simple linear interaction effects. Polynomial regression and response surface analysis assessed congruence following Edwards and Parry (1993).

Table 4. OLS Regression Predicting Circular Outcomes ($R^2 = 0.341$)

Predictor	β	SE	p
I_cap (std.)	0.420	0.139	.003
E_pres (std.)	1.136	0.112	<.001
I_cap × E_pres	-0.030	0.124	.814

The non-significant interaction term (Table 4: $\beta = -0.030$, $p = .814$) suggests that, within this high-capability sample, capability and pressure effects operate additively rather than synergistically. However, this finding should be interpreted cautiously given two constraining factors. First, the severely restricted variance in internal capability (SD = 0.31 vs. SD = 1.07 for external pressure) substantially reduces statistical power to detect interaction effects (Aguinis et al., 2017). Second, the absence of low-capability observations means we cannot test whether synergistic effects emerge when capability variance is greater. Consequently, our findings neither confirm nor falsify multiplicative alignment theory (Venkatraman, 1989); rather, they suggest that in mature, high-capability contexts, additive mechanisms may be more observable within the constraints of this sample (Misangyi et al., 2017).

Table 5. Polynomial Regression (Fit Test) ($R^2 = 0.357$)

Term	Coefficient	SE	p
I_cap (b1)	1.396	0.438	.002
E_pres (b2)	1.032	0.217	<.001
I_cap^2	-0.081	0.129	.532
I_cap × E_pres	-0.162	0.148	.273
E_pres^2	0.262	0.112	.020

The response surface results suggest that institutional pressure activates capabilities once a baseline level is reached. Although the linear interaction in Table 4 is not significant, the polynomial results in Table 5 indicate a non-linear effect (E_pres^2, $p = .020$), where pressure becomes more influential at higher levels. This supports a configurational view of alignment as positional fit rather than multiplicative interaction.

6. Discussion

The findings are consistent with the interpretation that, in mature contexts, digital circular transformation may be more contingent on capability activation than on further capability development. With organisations exhibiting relatively homogeneous digital-circular capabilities, substantial variation in institutional pressure emerges as the primary driver of circular outcomes, shifting analytical focus from resource accumulation to the conditions enabling capability mobilization and scaling.

In practice, a timber contractor possessing advanced BIM capabilities, design-for-disassembly expertise, and secondary material partnerships may still default to linear practices without client demand for circular solutions or regulatory differentiation. The capability exists but remains economically dormant absent supportive institutional architecture.

Both internal capability and external pressure independently enhance circular outcomes; however, the absence of significant interaction effects indicates they operate through parallel rather than multiplicative mechanisms. Capabilities reflect readiness to execute circular practices, while institutional pressure shapes the incentives, legitimacy, and conditions for activation and scaling (Cruz Rios et al., 2021; Hjaltadóttir & Hild, 2021).

These results support a context-contingent view of capability value: digital-circular capabilities appear necessary but insufficient for performance, with outcome variation driven primarily by institutional alignment. This reinforces the SPM's central proposition that strategic value depends on capability-context configuration within a broader system (Venkatraman, 1989).

6.1. Theoretical Contributions

This study contributes to strategy and circular economy research by introducing a parsimonious configurational alignment framework linking internal digital–circular capabilities with external institutional pressures, extending prior work that has largely examined these dimensions separately (Geissdoerfer et al., 2017; Kristoffersen et al., 2020). Compared with prior RBV-institutional integrations (Oliver, 1997; Hart & Dowell, 2011), the SPM makes capability contingency analytically explicit through two-dimensional mapping and theorizes boundary conditions where capability variance becomes secondary to institutional variance. It further refines capability-based perspectives by specifying a boundary condition: when capability variance is limited, institutional–market pressure becomes the primary source of outcome heterogeneity, shaping the activation and relevance of digital–circular capabilities (Oliver, 1997; Seles et al., 2022). Finally, the study conceptualizes alignment as configuration, reflected in positional patterns and congruence, rather than solely as interaction effects (Venkatraman, 1989).

6.2. Strategic and Managerial Implications

The findings indicate that digital–circular capabilities alone are insufficient to drive circular outcomes; their effectiveness depends on alignment with institutional pressure. In weak institutional environments, firms should prioritize experimentation, capability consolidation, and ecosystem engagement. Under stronger institutional pressure, the focus shifts toward scaling circular business models and coordinating value chain actors (Yevu et al., 2021).

For policymakers, the results suggest that regulatory pressure alone is insufficient to accelerate circular transformation if firms lack the capabilities required to respond effectively (Cruz Rios et al., 2021; Hjaltadóttir & Hild, 2021). Policy interventions should therefore combine institutional pressure with capability-building measures, including digital infrastructure support and industry collaboration mechanisms (Bag et al., 2021).

6.3. Framework Generalizability

Although empirically illustrated in Nordic wood construction, the SPM's strategic logic extends to other digitally advanced, regulation-intensive industries experiencing baseline capability saturation. In sectors such as electronics, textiles, and automotive, effective deployment of lifecycle and tracking capabilities similarly depends on institutional drivers like extended producer responsibility and circular procurement policies. More broadly, this capability-context alignment logic applies to other sustainability transitions (decarbonization, digital transformation, resource efficiency), positioning the SPM as a generalizable strategic lens for understanding how organisational capabilities translate into outcomes through institutional environments.

6.4. Limitations and Future Research

Several limitations guide future research. First, the cross-sectional design constrains causal inference, necessitating longitudinal studies to track configurational transitions over time. Second, reliance on managerial perceptions should be complemented with objective performance indicators (e.g., material reuse rates, waste reduction). Third, the Nordic wood construction focus warrants testing the SPM across diverse sectors to assess generalizability. Finally, the network-based sampling likely contributes to the absence of low-capability firms in the sample, which may limit generalizability and partly explain the observed high capability floor.

7. Conclusion

This study introduces the DCAM SPM as a strategic framework for understanding digital circular transformation as an alignment challenge between internal capabilities and external institutional pressures. By integrating the RBV and institutional theory, it reframes circular transformation from a problem of technological adoption to one of strategic positioning, where the value of organisational capabilities depends on the institutional environments in which they are deployed.

Empirical findings from Nordic wood construction reveal a clear structural asymmetry: digital–circular capabilities are relatively well developed across firms, while institutional pressures vary substantially. This indicates that variation in circular outcomes is less a function of capability availability and more a question of capability activation, shaped by regulatory frameworks, market expectations, and ecosystem coordination.

The study contributes to strategy research by demonstrating that digital–circular capabilities function as context-contingent resources whose strategic value emerges through alignment with external conditions. It also extends institutional perspectives by showing that institutional pressures influence not only the adoption of circular practices but their effective deployment and scaling.

Practically, the SPM provides a diagnostic tool for assessing strategic positioning, identifying capability gaps, and guiding both managerial and policy interventions. Overall, digital circular transformation depends not only on what organisations can do, but on whether institutional conditions enable them to do it.

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Data availability The data that support the findings of this study are openly available in Zenodo at https://doi.org/10.5281/zenodo.19440858, (Lindblad, 2026b). The repository includes the anonymised raw dataset and variable descriptions.

Declarations

Competing Interests The authors declare no competing interests.

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Appendices

Appendix A: Survey Items and Operationalization (1-10 scale)

Digital Infrastructure (4 items)

- Our organization uses BIM with interoperable data standards for lifecycle management
- We deploy IoT sensors and digital twins for real-time performance monitoring
- AI-based analytics inform our material selection and waste optimization decisions
- Our data governance systems enable secure lifecycle transparency across supply chains

Circular Strategies (4 items)

- We systematically apply design-for-disassembly principles in project planning
- Our projects incorporate modular components designed for material recovery and reuse
- We use predictive maintenance systems to extend component lifespans in our operations
- Our procurement practices prioritize secondary materials and circular suppliers

Business Models (4 items)

- We offer product-as-a-service or component leasing models in our offerings
- We participate in digital or physical marketplaces for secondary construction materials
- Our contracts incorporate performance-based incentives aligned with circular outcomes
- We operate take-back or refurbishment programs for building components

Organizational Capabilities (4 items)

- Executive leadership explicitly prioritizes circular economy in strategic planning
- Cross-functional coordination mechanisms ensure integration across business units
- Employees receive regular training on circular principles and digital tools
- We maintain active collaborative partnerships supporting circular innovation

External Pressure (8 items)

- Current regulations strongly mandate circular construction practices in our market
- Government procurement policies actively prioritize circular performance criteria
- Our clients actively request circular performance documentation and outcomes
- End-users demonstrate willingness to pay premium prices for circular features
- Competitor circular offerings create competitive pressure in our market
- Well-functioning digital marketplaces for secondary materials exist in our ecosystem
- Certification schemes for reclaimed components are available and accessible
- Industry consortia actively support circular innovation and knowledge-sharing

Circular Performance Outcomes (5 items)

- We source material inputs from secondary or circular sources
- We divert construction waste from landfill
- We extend component lifespans relative to conventional linear baseline
- We are confident in achieving circular business model objectives within three years
- Our organization has made substantial progress toward circular economy alignment