

Original Research

Innovation Coherence as a Strategic Determinant of Firm Value and Growth

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Abstract

Innovation research has long emphasized the quantity of inventive effort, yet firms rarely compete on raw inventive volume alone. What often matters in practice is whether a firm's disclosed innovation priorities, resource commitments, and realized outputs move in a mutually reinforcing direction that outside evaluators can understand and internal decision makers can execute. This study develops and tests the concept of innovation coherence, defined as the within-firm alignment among innovation disclosure, knowledge investment, commercialization output, and environmental innovation activity. Using a panel of 418 publicly listed U.S. firms observed from 2014 to 2023, yielding 3,144 firm-year observations, the analysis combines text-derived disclosure measures, accounting-based investment measures, patenting activity, verified product launch data, and environmental innovation indicators. The results show that higher innovation coherence is associated with higher next-year Tobin's Q, stronger revenue growth, and lower operating cash-flow volatility, even after controlling for overall innovation intensity, firm fixed effects, year effects, and multiple sources of endogeneity. The estimated valuation effect is economically moderate: moving from the first to the third quartile of coherence is associated with a 6.8% increase in next-year firm value. The effect is stronger when firms possess a stronger preexisting innovation reputation and when product-market competition is moderate rather than weak or extreme. By contrast, heavy concentration of inventive effort in a narrow technological portfolio weakens the gains from coherence. Mediation analyses indicate that part of the coherence effect operates through innovation conversion efficiency, meaning that aligned firms translate R&D effort into market-facing outputs more effectively. The findings suggest that investors and managers respond not simply to more innovation, but to innovation organized in a credible and internally consistent architecture.

1. Introduction

Innovation is frequently described as a central mechanism through which firms secure growth, differentiate offerings, and preserve strategic relevance under technological change. That proposition is intuitively persuasive, but it conceals an analytically important complication. Many firms appear innovative in one organizational layer while remaining fragmented in another. Some issue ambitious innovation narratives while allocating only modest resources. Others sustain sizable R&D budgets but commercialize sporadically. Still others innovate intensely in technical domains while failing to build a market-facing story that allows investors, employees, channel partners, and customers to infer a stable strategic direction [1]. In these circumstances, the question is not simply whether a firm innovates, but whether the firm innovates coherently. This paper examines that issue by proposing that innovation should be evaluated as a structured configuration rather than as a collection of loosely related activities.

The core claim advanced here is that firms create greater economic value when their innovation architecture is internally aligned across four observable domains: strategic disclosure, resource commitment, realized commercialization, and environmental innovation. Alignment matters because firms

do not operate in a frictionless setting where every internal project is perfectly observed and instantaneously interpreted. Innovation is judged indirectly. Employees infer priorities from resource allocations. investors infer future cash flows from disclosed commitments and visible outputs. Channel partners and complementors infer reliability from the pattern of launches and technical follow-through. Regulators and communities increasingly infer long-horizon credibility from the environmental profile of innovation itself. When these signals reinforce one another, interpretation becomes easier and execution becomes more disciplined. When they diverge, both valuation and implementation may suffer.

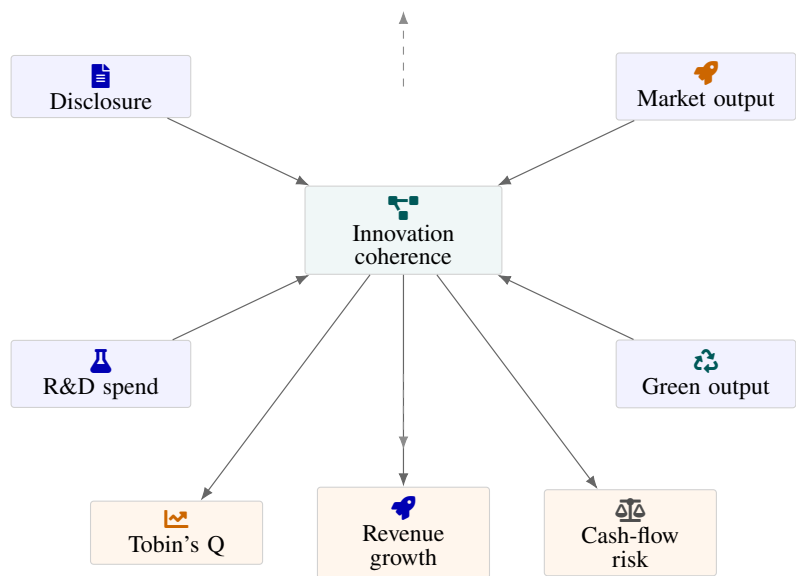


Figure 1: Core architecture of the study. The figure organizes the four observed innovation domains into a single coherence hub and then maps that hub to the next-year outcomes emphasized in the empirical design: firm value, revenue growth, and operating cash-flow risk.

This perspective differs from a substantial portion of the empirical literature, which tends to operationalize innovation in a single dimension, often through patent counts, citation-weighted patent quality, R&D intensity, or new product introductions. Each of those measures is useful. Yet each captures only one projection of a multidimensional construct. A firm with a high patent count may be technically active but commercially diffuse. A firm with high disclosure salience may be rhetorically ambitious but operationally thin. A firm with repeated product launches may be visible in the market but technologically dependent on old knowledge stocks [2]. An innovation strategy can therefore be strong on one margin and weak on another. Treating these margins as interchangeable risks masking a central organizational question: whether the pieces of the innovation system fit together tightly enough to create a believable and executable strategic path.

The emphasis on coherence also responds to a problem of interpretation under information asymmetry. Outside observers rarely have direct access to project-level screening rules, internal kill rates, or the microeconomics of cross-functional coordination. They instead observe bundles of signals and attempt to infer whether those signals point to durable future value or merely to strategic theater. In settings characterized by high uncertainty, credible innovation signals may soften otherwise negative interpretations of firm behavior. Cao et al. (2023) [3] show this logic in the IPO setting, where innovation potential mitigates adverse valuation implications associated with insider selling. That result is important not only for IPO research but also for the broader study of innovation, because it suggests that market participants do not treat innovation as decorative language. They use it as a probabilistic cue about whether the firm’s

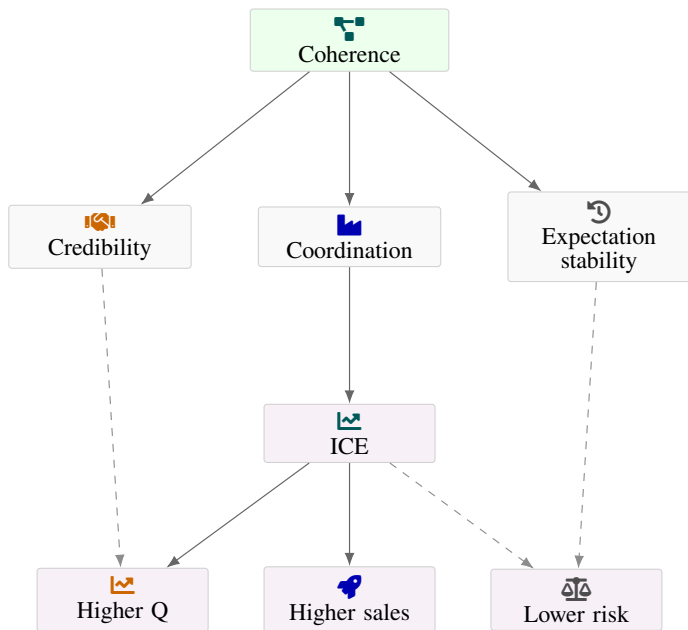


Figure 2: Mechanism map. The layout separates the three theorized channels—interpretive credibility, organizational coordination, and expectation stability—and shows how they funnel part of the effect through innovation conversion efficiency before appearing in valuation, growth, and risk outcomes.

future opportunities are strong enough to offset concern generated elsewhere. The present study extends that logic from the existence of innovation potential to the alignment of innovation activities over time.

The argument developed in this paper is that innovation coherence should influence firm value through three related pathways. First, aligned innovation systems reduce interpretive ambiguity. When disclosure, spending, outputs, and environmental innovation move together, investors are less likely to discount the firm’s innovation posture as symbolic or transitory. Second, coherence improves innovation conversion efficiency. Cross-functional processes become easier to prioritize when project selection, communication, and commercialization follow a consistent directional logic. Third, coherence may stabilize expectations among internal and external stakeholders, reducing the volatility that arises when firms oscillate between distant innovation agendas or signal ambitions they do not operationalize. These mechanisms imply that coherence should matter even after controlling for the average level of innovation itself.

At the same time, coherence should not be confused with narrowness. An organization can be coherent without being technologically monolithic, and it can be specialized without being strategically aligned. This distinction is important because some firms achieve a strong internal narrative by concentrating heavily in a narrow technological area, yet such concentration can reduce recombination opportunities and increase dependence on a limited set of search trajectories. The value of innovation coherence may therefore depend on whether it is achieved through disciplined alignment or through restrictive concentration. The empirical design developed below is structured to separate these possibilities.

The study makes three contributions. First, it introduces an operational measure of innovation coherence that treats innovation as a vector of coordinated domains rather than as a scalar input or output. Second, it shows that coherence predicts next-year valuation, growth, and risk outcomes beyond innovation intensity alone. Third, it identifies boundary conditions: the gains from coherence are amplified by prior innovation reputation and by moderate competition, but weakened by excessive concentration of the inventive portfolio. These results suggest that firms benefit from a coherent innovation system not

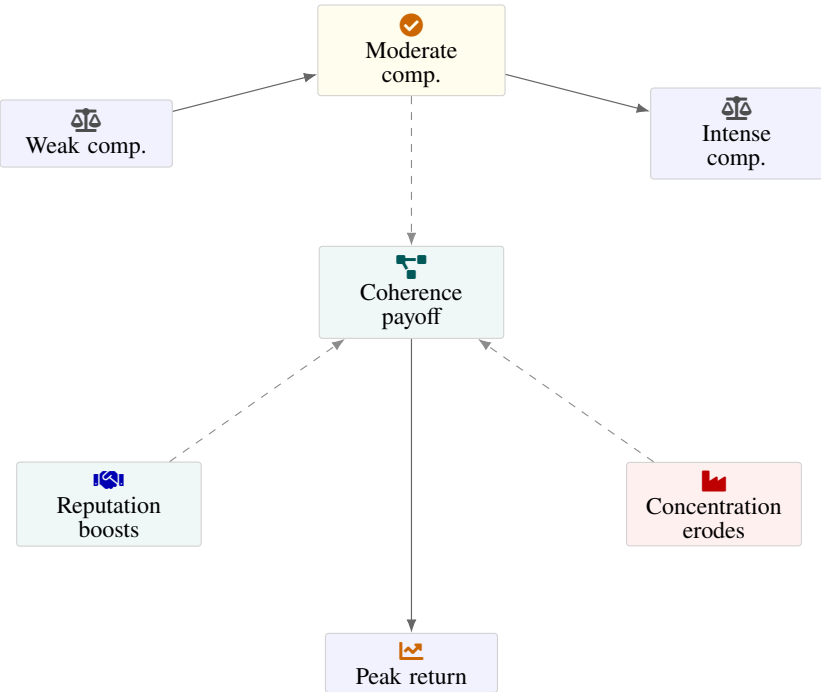


Figure 3: Boundary-condition view. The competition path is drawn as an inverted-U logic in discrete form, with the strongest coherence return at moderate competitive pressure. The lower flank records the asymmetric firm-level contingencies: prior innovation reputation strengthens the effect, whereas narrow knowledge concentration weakens it.

merely because it looks orderly, but because the system improves the conversion of inventive effort into credible economic expectations.

2. Theoretical Development

A coherent innovation system can be understood as one in which multiple organizational signals point in the same strategic direction. This idea draws on the view that innovation creates not only technical assets but also interpretive structures that shape how others understand the firm. In a market-facing context, innovation often generates intellectual assets and relational assets simultaneously. Cao et al. (2024a) [4] develop this idea in their analysis of marketing ideation crowdsourcing contests, where investor reactions depend on the degree to which a contest appears capable of generating useful knowledge while also deepening engagement with external audiences. That framing is especially helpful here because it implies that innovation has a dual nature. It produces technical options, but it also produces social evidence regarding whether the firm can organize participation, attract attention, and make its strategic direction legible. Innovation coherence should therefore matter because it reinforces both cognitive and relational interpretations of the firm’s innovation posture.

The first mechanism is interpretive credibility. Firms that disclose innovation ambitions without parallel resource commitments invite skepticism. Firms that invest heavily without visible commercialization invite questions about conversion efficiency. Firms that commercialize without corresponding technical investment may be interpreted as harvesting old knowledge rather than renewing capabilities. Environmental innovation adds another interpretive layer because it increasingly signals whether the firm’s innovation architecture is responsive to stakeholder concerns beyond immediate product performance. When these domains align, the resulting pattern is more difficult to dismiss as symbolic

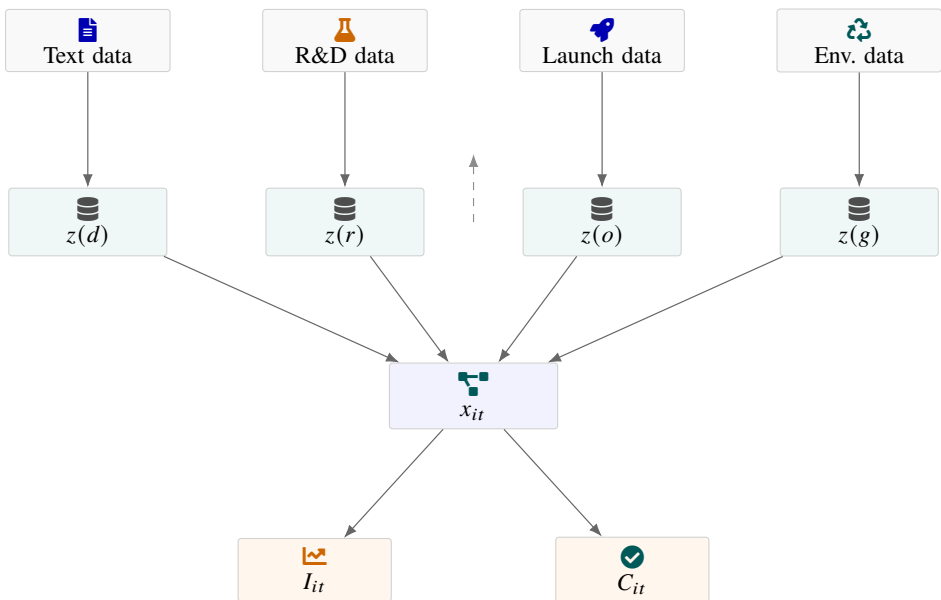


Figure 4: Measurement pipeline. The figure follows the paper’s construction from four raw firm-year inputs, through within-cell standardization, into the innovation vector, and finally into the split between average innovation intensity and the dispersion-based coherence measure.

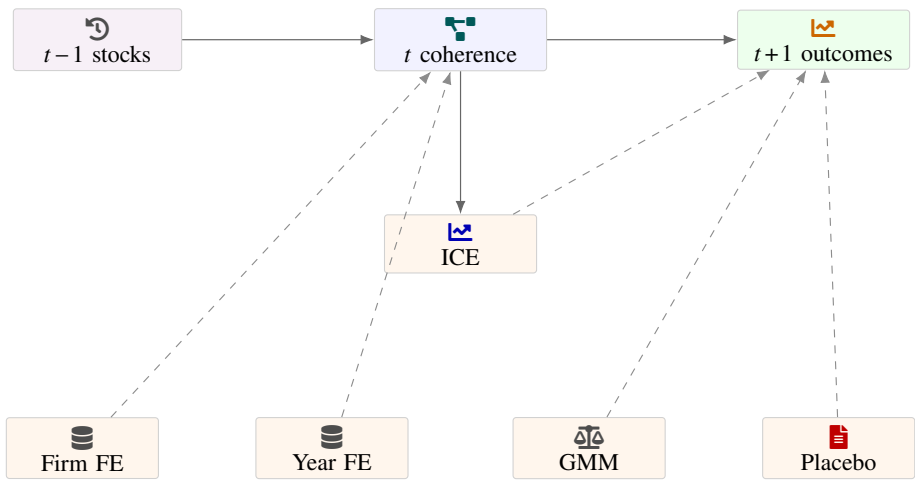


Figure 5: Econometric flow. The timeline places lagged reputation and instrument-related variation before the current-period coherence block, routes the mediator through next-year outcomes, and adds the major design safeguards used in the empirical section: fixed effects, dynamic-panel validation, and placebo checks.

management. Coherence effectively increases the signal-to-noise ratio of innovation. Investors can map disclosed ambitions to resource use, resource use to output, and output to a broader strategic narrative [5]. A coherent pattern is therefore more likely to elevate perceived persistence of future cash flows.

The second mechanism is organizational coordination. Innovation programs are rarely executed within a single department. Strategic planning, research, engineering, operations, marketing, legal review, and external communications all influence whether projects survive, scale, and gain adoption. When the innovation system is coherent, these functions face fewer conflicts over prioritization and sequencing. Resource allocation choices support the same domains that disclosure emphasizes [6].

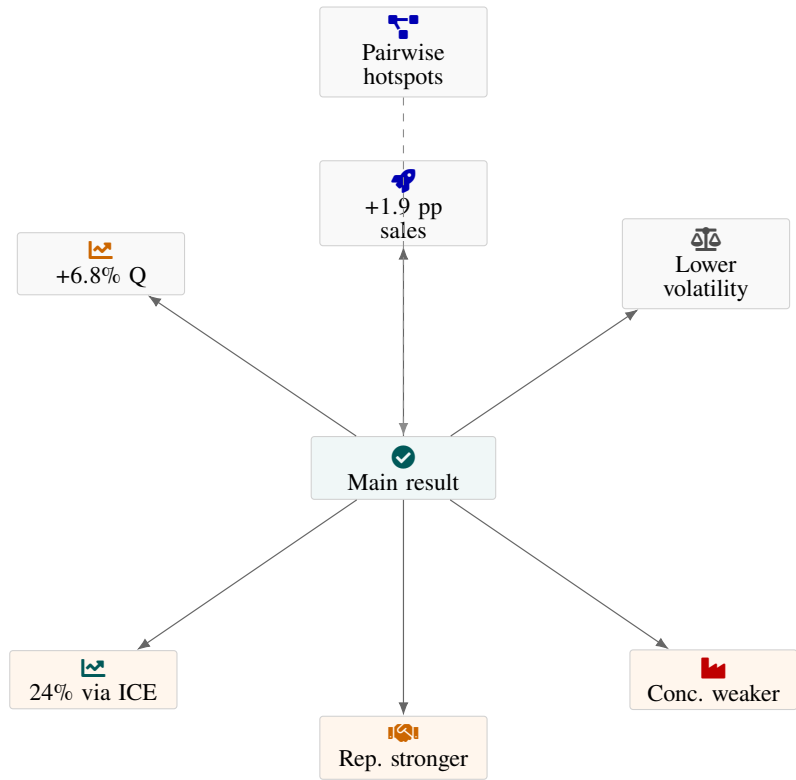


Figure 6: Compact result board. The central node summarizes the positive coherence effect, while the perimeter records the economically moderate magnitudes, the mediated share through innovation conversion efficiency, and the two directional moderators highlighted by the estimates.

Commercialization routines are prepared for the same categories of output that technical teams are encouraged to develop. Environmental innovation is not bolted on after the fact but integrated into design and process development. Coordination costs do not disappear under coherence, but they are less likely to be spent reconciling contradictory agendas [7]. That reduction in friction should improve the ratio of realized innovation output to innovation input.

The third mechanism is expectation stability. Firms that rotate frequently across unrelated innovation stories may create bursts of excitement, but they also increase uncertainty about future identity and strategic discipline [8]. Because innovation projects are long-cycle investments with deferred payoffs, stakeholders form beliefs not only about current effort but also about likely continuation. Coherence stabilizes those beliefs by making the innovation path appear less arbitrary. This is especially relevant for external financing because the market often evaluates innovation under incomplete observability. If aligned signals make the firm’s path easier to forecast, the discount rate applied to uncertain future benefits may fall modestly. The effect need not be dramatic to matter economically; even a moderate reduction in interpretive uncertainty can be reflected in higher valuation multiples [9].

From these arguments follows the first expectation: innovation coherence should be positively associated with future firm value and growth, even after controlling for innovation intensity. The point is not that aligned firms necessarily innovate more in every period, but that they innovate in a more interpretable and more implementable manner. A coherent firm may allocate the same average R&D share as an incoherent firm while extracting greater economic value from it because the broader innovation system is synchronized.

A further implication concerns innovation conversion efficiency. Conversion efficiency refers here to the firm’s ability to transform innovation-oriented expenditure into observable inventive and commercial

outputs. This is not identical to productivity in a narrow engineering sense. It includes the organizational capacity to screen projects, integrate functions, and commercialize in a manner consistent with the strategic narrative. If coherence improves coordination and reduces interpretive conflict, then part of its effect on value should operate through higher conversion efficiency. The mediation logic is straightforward: coherence improves the internal translation of effort into output, and the market values the firm more highly because it detects that translation.

The value of coherence should nevertheless vary across competitive contexts. Competition can sharpen the rewards to coherent innovation by increasing the need to commercialize quickly and by making diffuse strategies more costly. Yet beyond a point, competition may erode returns because rivals imitate, price pressure intensifies, and the private rents to innovation diminish. Cao et al. (2025) [10] show in the environmental innovation domain that financial returns to innovation are shaped by both market-level competition and firm-level capabilities, with gains strongest under particular competitive conditions rather than uniformly across all contexts. This suggests a nonlinear boundary condition for the present study: coherence should be especially valuable when competitive pressure is sufficient to discipline execution but not so extreme that appropriation becomes too difficult. The expected pattern is therefore an inverted-U moderation, in which coherence pays off most under moderate competition [11].

A second boundary condition concerns the structure of the firm’s inventive search. It is possible to create apparent coherence by concentrating attention, resources, and outputs in a narrow technological corridor. Such concentration can simplify communication and reduce coordination burden in the short run. Yet a very narrow corridor may also depress the recombination benefits that broader search can provide. Cao et al. (2024b) [12] show in the incubator context that greater specialization can reduce R&D efficiency by intensifying knowledge leakage risks and restricting heterogeneous knowledge inflows. The broader lesson is that specialization and efficiency do not move together monotonically. Applied to public firms, this logic implies that heavy concentration of the inventive portfolio may weaken the returns to coherence. Coherence derived from disciplined integration should be advantageous, but coherence achieved through excessive technological narrowness may be brittle.

The final boundary condition is prior innovation reputation. A firm with a well-established record of credible innovation is more likely to have its current coherent signals interpreted favorably. Reputation creates a stock of belief that conditions how present actions are received. When a high-reputation firm communicates a coherent innovation path, stakeholders may infer that the alignment reflects a durable capability rather than temporary managerial enthusiasm. By contrast, a low-reputation firm may need repeated periods of coherent behavior before observers revise their priors. The expected implication is that prior innovation reputation should strengthen the coherence effect on value.

Taken together, these arguments yield a compact framework. Innovation coherence should increase future firm value directly through improved interpretive credibility and lower expectation instability, and indirectly through greater innovation conversion efficiency. The magnitude of this effect should rise with prior innovation reputation, peak under moderate competition, and weaken when the firm’s inventive portfolio becomes too concentrated. The empirical sections that follow develop a multidimensional measure of coherence and test these predictions in a panel of publicly listed firms [13].

Table 1: Sample Description and Coverage

Category	Count	Percentage	Notes
Firms	418	100%	Public U.S. firms
Firm-year observations	3,144	100%	2014–2023 panel
Industries covered	8	–	Multi-sector sample
Excluded sectors	2	–	Finance, utilities
Min years per firm	3	–	Inclusion criterion

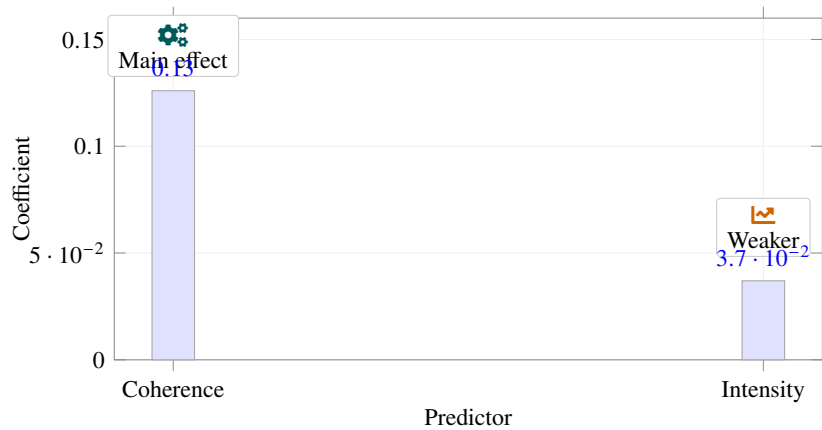


Figure 7: Baseline valuation coefficients. Innovation coherence (0.126) is materially larger than innovation intensity (0.037), indicating that alignment across innovation domains is more strongly associated with next-year Tobin’s Q than average innovation level alone.

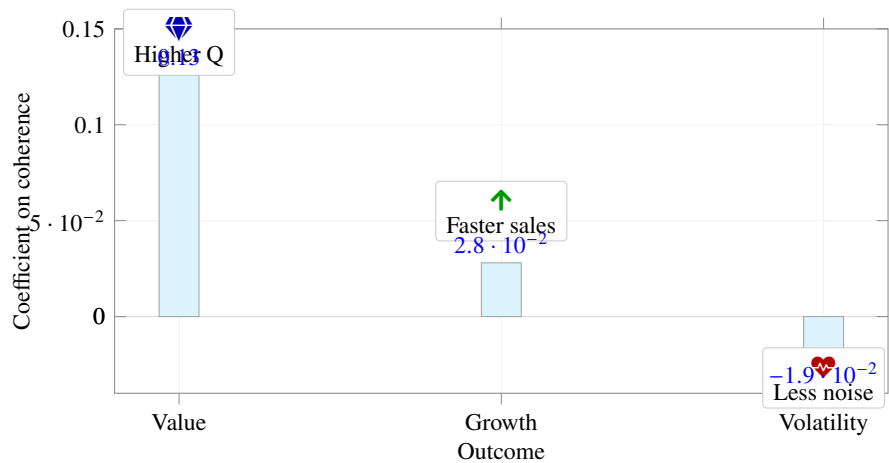


Figure 8: Outcome profile of innovation coherence. The same coherence construct is positively related to firm value and revenue growth, and negatively related to subsequent cash-flow volatility.

3. Data and Measures

The empirical setting consists of publicly listed U.S. firms operating in sectors where innovation carries visible strategic content but where accounting comparability remains adequate for panel estimation. The sampling frame began with all firms in industrial equipment, chemicals, software, medical devices, consumer durables, business services, clean technology, and mobility-related services that appeared in Compustat during at least three consecutive years between 2014 and 2023. Financial firms and utilities were excluded because their balance-sheet structures, regulatory regimes, and innovation incentives differ materially from those of the focal sectors. Firms with zero reported sales, missing total assets, or no available annual textual disclosure were removed. The resulting unbalanced panel contains 418 firms and 3,144 firm-year observations after winsorizing continuous variables at the 1% and 99% tails.

Several data sources were integrated at the firm-year level. Financial variables were drawn from audited annual reports and standardized accounting databases. Innovation disclosure was measured through text analysis of shareholder letters, annual report narratives, and management discussion sections, with manual screening to remove purely boilerplate uses of terms associated with innovation.

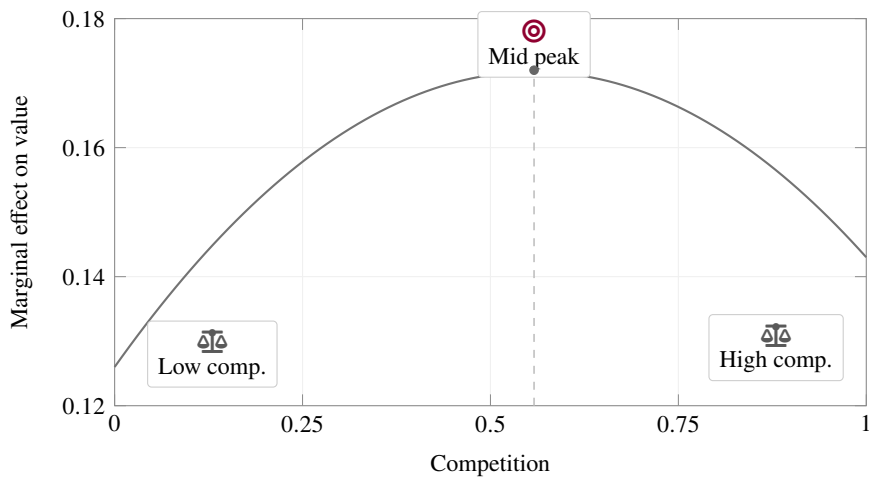


Figure 9: Competition moderation. The marginal value effect follows an inverted-U pattern from $\beta_1 + \beta_3 Comp + \beta_4 Comp^2$ with $\beta_1 = 0.126$, $\beta_3 = 0.164$, and $\beta_4 = -0.147$; the peak lies near the middle of the competition distribution.

Table 2: Key Variables and Definitions

Variable	Type	Measure	Source
Innovation Coherence	Index	Alignment score	Constructed
Innovation Intensity	Index	Mean across domains	Constructed
Tobin's Q	Dependent	Log(Q)	Compustat
Revenue Growth	Dependent	$\Delta Sales / Sales$	Financial data
Cash-flow Volatility	Dependent	Rolling std. dev.	Financial data

Table 3: Innovation Coherence Components

Component	Symbol	Description	Scaling
Disclosure	d_{it}	Text-based innovation signal	Industry-year
R&D Commitment	r_{it}	R&D intensity	Industry-year
Commercial Output	o_{it}	Product launches	Industry-year
Environmental Innovation	g_{it}	Green innovation activity	Industry-year

Patent data were compiled from granted and applied patents assigned to focal firms. Commercialization output was measured using verified product launch announcements and material service introductions identified in press release archives and firm investor communications. Environmental innovation activity was measured through a combination of environment-related patent classes and firm announcements concerning process redesigns, cleaner materials, energy-saving product features, emissions-reducing technologies, and circular design initiatives. To reduce year-specific scale distortions, each of the four core components was standardized within industry-year cells.

The key explanatory construct is innovation coherence. Let the standardized innovation architecture vector for firm i in year t be

$$x_{it} = \begin{bmatrix} d_{it} \\ r_{it} \\ o_{it} \\ g_{it} \end{bmatrix},$$

Table 4: Descriptive Statistics

Variable	Mean	Std. Dev.	Range
Coherence	0.742	0.109	0.41–0.93
Innovation Intensity	0.000	0.876	Standardized
Tobin's Q	1.84	0.67	0.9–4.5
Revenue Growth	0.071	0.122	-0.30–0.50
Cash-flow Volatility	0.093	0.041	0.02–0.21

Table 5: Baseline Regression Results

Variable	Firm Value	Growth	Volatility
Coherence	0.126***	0.028**	-0.019**
Innovation Intensity	0.037*	0.011	-0.006
Firm Size	0.052**	0.004	0.002
Leverage	-0.041*	-0.009	0.008

Table 6: Moderation by Competition

Variable	Coefficient	Std. Error	Significance
Coherence $\times$ Competition	0.164	0.058	**
Coherence $\times$ Competition ²	-0.147	0.061	**
Competition	0.072	0.033	*
Competition ²	-0.065	0.029	*

Table 7: Moderation by Reputation and Concentration

Variable	Coefficient	Std. Error	Effect
Coherence $\times$ Reputation	0.049	0.023	Positive
Coherence $\times$ Concentration	-0.038	0.017	Negative
Reputation	0.061	0.028	Positive
Concentration	-0.055	0.025	Negative

Table 8: Mediation via Innovation Conversion Efficiency

Path	Coefficient	Std. Error	Result
Coherence $\rightarrow$ ICE	0.116	0.034	**
ICE $\rightarrow$ Firm Value	0.221	0.067	***
Indirect Effect	0.026	–	Significant
Direct Effect	0.100	–	Partial

where d_{it} denotes disclosure intensity, r_{it} R&D commitment, o_{it} realized commercialization output, and g_{it} environmental innovation activity. Let $\mathbf{1}$ be a four-dimensional column vector of ones and let $M = I_4 - \frac{1}{4}\mathbf{1}\mathbf{1}'$ denote the centering matrix. The scalar

$$I_{it} = \frac{1}{4}\mathbf{1}'x_{it}$$

Table 9: Robustness Checks

Specification	Coherence Coef.	Method	Outcome
Baseline FE	0.126	Fixed effects	Significant
Alt. CV Measure	0.109	Fixed effects	Significant
Cosine Similarity	0.103	Fixed effects	Significant
System GMM	0.118	Dynamic panel	Significant
Matched Sample	0.059	Matching	Consistent

Table 10: Pairwise Alignment Effects

Pair	Coefficient	Strength	Interpretation
Disclosure–Output	0.082	Strong	Market credibility
R&D–Environmental	0.074	Strong	Sustainability alignment
Disclosure–R&D	0.051	Moderate	Strategic consistency
Output–Environmental	0.046	Moderate	Execution linkage

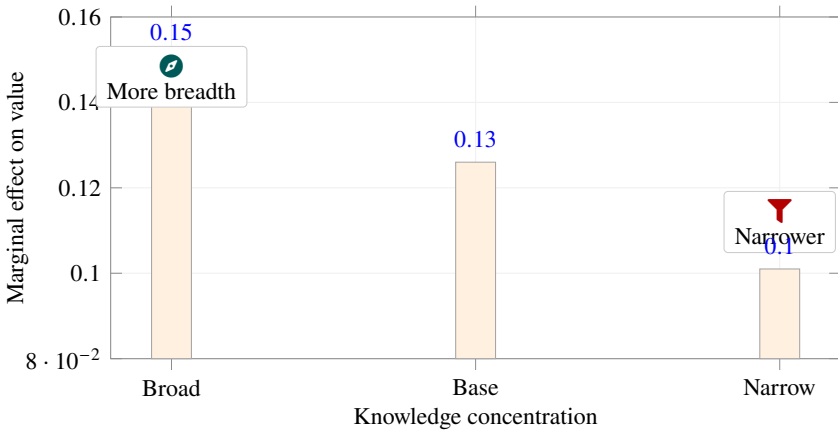


Figure 10: Knowledge concentration weakens the coherence premium. The low/base/high bars are compact reconstructions anchored to the reported result that a one-standard-deviation increase in concentration reduces the marginal effect of coherence by roughly one-fifth.

captures average innovation intensity across the four domains, while the residual vector $u_{it} = Mx_{it}$ captures within-firm misalignment. Innovation coherence is then defined as

$$C_{it} = 1 - \sqrt{\frac{x'_{it} M x_{it}}{4 + \|x_{it}\|_2^2}},$$

which lies near one when the four domains move closely together and falls as their dispersion increases. The denominator prevents firms with uniformly high or uniformly low innovation levels from mechanically dominating the dispersion term. Because I_{it} is entered separately in the regressions, the coherence effect is identified as alignment conditional on average innovation level.

The first dependent variable is next-year firm value, measured as the natural logarithm of Tobin’s Q [14]. The second is next-year revenue growth, calculated as the change in sales divided by lagged sales. The third is operating cash-flow volatility, computed as the rolling standard deviation of quarterly operating cash flow over the subsequent four quarters. These outcomes capture, respectively, market valuation, realized growth, and an important dimension of uncertainty. The mediation variable, innovation

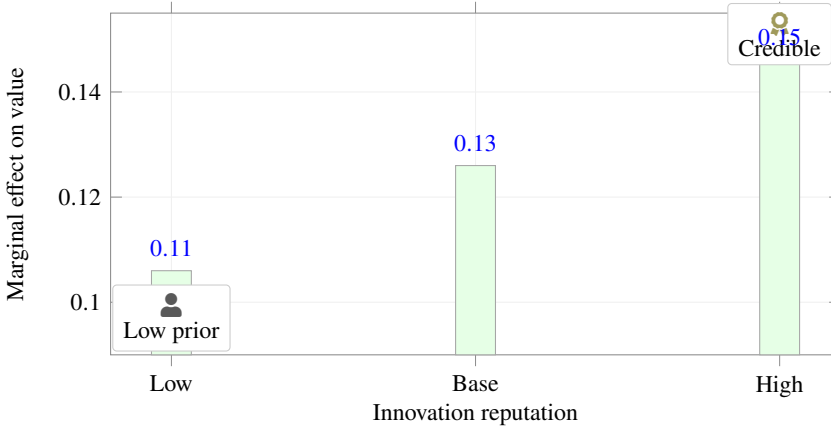


Figure 11: Innovation reputation strengthens the coherence premium. The low/base/high bars are compact reconstructions centered on the reported result that the marginal effect is about 38% larger for firms one standard deviation above the mean in reputation than for firms one standard deviation below it.

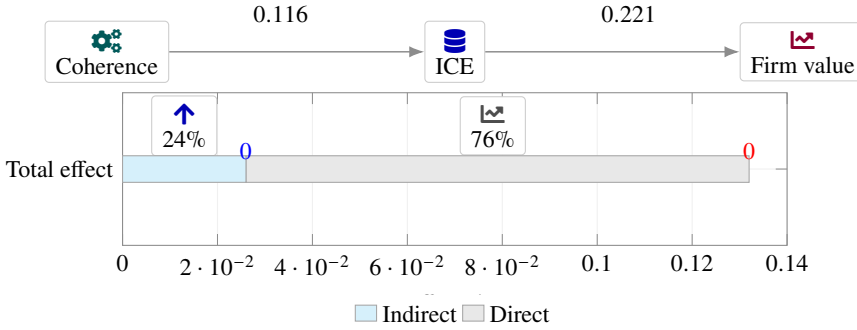


Figure 12: Partial mediation through innovation conversion efficiency. Coherence predicts next-year ICE (0.116), ICE predicts firm value (0.221), and the indirect effect is 0.026, accounting for about 24% of the total coherence effect.

conversion efficiency, combines inventive and commercialization outputs relative to innovation-oriented spending [15]. Specifically, the measure is

$$ICE_{it} = \log \left(1 + \frac{\text{Patents}_{it} + 0.7 \text{Launches}_{it}}{1 + \text{R\&D}_{it} / \text{Sales}_{it}} \right),$$

where product launches receive a fractional weight to reflect commercial significance without assuming one launch equals one patent economically. Alternative weights are considered in robustness analysis.

Competition is captured through an inverse-concentration product-market measure based on firm-level sales shares within four-digit industry segments. To test nonlinearity, both the linear and squared terms of competition are included in interactions with coherence. Prior innovation reputation is constructed as a decayed stock of innovation visibility and originality [16]. The stock updates recursively as

$$Rep_{it} = 0.7 Rep_{i,t-1} + 0.3 \tilde{O}_{it},$$

where $\tilde{O}_{it}$ is a standardized composite of patent originality, launch novelty, and prior external recognition of innovation programs. This stock is intended to capture accumulated credibility rather than contemporaneous publicity.

Knowledge concentration is measured with a Herfindahl index over the firm's patent classes and launch categories. High values indicate that inventive activity is clustered in a narrow set of domains. This variable is conceptually distinct from coherence. A firm can be coherent with a diversified search portfolio if disclosure, spending, output, and environmental activity align around a related set of strategic themes. Likewise, a firm can be concentrated yet incoherent if it speaks broadly while spending narrowly or spends heavily without consistent output [17].

The control set includes firm size, leverage, capital intensity, intangible intensity, advertising intensity, cash holdings, return on assets, firm age since listing, analyst coverage, prior stock return, and year and firm fixed effects. Industry-year demand conditions are further controlled using median segment growth. Because innovation disclosure may be correlated with managerial optimism more broadly, a non-innovation strategic language control was created from the frequency of generic growth and transformation terms that do not specifically refer to innovation. This allows the analysis to distinguish innovation coherence from overall narrative assertiveness.

Descriptive statistics suggest meaningful variation. The mean coherence score is 0.742 with a standard deviation of 0.109. The correlation between coherence and average innovation intensity is positive but moderate, indicating that aligned firms tend to innovate somewhat more, though the constructs are not collinear. Firms in the top quartile of coherence show higher mean firm value, stronger revenue growth, and lower subsequent cash-flow volatility than firms in the bottom quartile. These unadjusted differences are informative but not dispositive, since coherent firms could differ systematically along many dimensions. The econometric strategy therefore emphasizes within-firm variation and multiple checks against reverse causality and omitted variables.

4. Econometric Strategy

The empirical analysis proceeds in four steps. The first step estimates the baseline relationship between innovation coherence and next-year outcomes using firm and year fixed effects. The second step adds the proposed moderators: competition, knowledge concentration, and prior innovation reputation [18]. The third step evaluates mediation through innovation conversion efficiency. The fourth step addresses endogeneity through lag structure, control-function logic, alternative estimators, and placebo analysis. The central design choice is to predict future rather than contemporaneous outcomes, thereby reducing the scope for simple simultaneity between innovation coherence and firm value.

The baseline model for firm value is [19]

$$\ln(Q_{i,t+1}) = \alpha_i + \tau_t + \beta_1 C_{it} + \beta_2 I_{it} + \gamma' Z_{it} + \varepsilon_{i,t+1}, \quad (4.1)$$

where α_i denotes firm fixed effects, τ_t year effects, C_{it} innovation coherence, I_{it} average innovation intensity, and Z_{it} the vector of controls. Analogous specifications are estimated for revenue growth and operating cash-flow volatility [20]. The coefficient of primary interest is β_1 , which measures whether alignment across innovation domains predicts future outcomes conditional on average innovation intensity.

To test the nonlinear moderation of competition, the model extends to

$$\begin{aligned} \ln(Q_{i,t+1}) = & \alpha_i + \tau_t + \beta_1 C_{it} + \beta_2 I_{it} \\ & + \beta_3 C_{it} \text{Comp}_{it} + \beta_4 C_{it} \text{Comp}_{it}^2 \\ & + \beta_5 \text{Comp}_{it} + \beta_6 \text{Comp}_{it}^2 \\ & + \gamma' Z_{it} + \varepsilon_{i,t+1}. \end{aligned} \quad (4.2)$$

A positive β_3 combined with a negative β_4 would indicate that the valuation return to coherence rises with competition up to a point and then weakens. The reputation and knowledge concentration moderators are tested in separate and combined specifications:

$$\begin{aligned}\ln(Q_{i,t+1}) = & \alpha_i + \tau_t + \beta_1 C_{it} + \beta_2 I_{it} \\ & + \beta_3 C_{it} Rep_{it} + \beta_4 C_{it} Conc_{it} \\ & + \beta_5 Rep_{it} + \beta_6 Conc_{it} \\ & + \gamma' Z_{it} + \varepsilon_{i,t+1}.\end{aligned}\quad (4.3)$$

The mediation analysis uses a two-equation framework. First, innovation conversion efficiency is regressed on coherence and controls: [21]

$$\begin{aligned}ICE_{i,t+1} = & \mu_i + \kappa_t + \pi_1 C_{it} + \pi_2 I_{it} \\ & + \rho' Z_{it} + \nu_{i,t+1}.\end{aligned}\quad (4.4)$$

Second, firm value is regressed on both coherence and the mediator:

$$\begin{aligned}\ln(Q_{i,t+1}) = & \alpha_i + \tau_t + \theta_1 C_{it} + \theta_2 ICE_{i,t+1} \\ & + \theta_3 I_{it} + \gamma' Z_{it} + \varepsilon_{i,t+1}.\end{aligned}\quad (4.5)$$

The indirect effect is given by $\pi_1 \theta_2$, and inference is based on clustered bootstrap resampling at the firm level. The identification claim is modest. The mediation analysis is intended to assess whether the data are consistent with the proposed process mechanism, not to establish a fully causal decomposition under all possible forms of latent confounding.

Because coherence could be influenced by expected future performance, several safeguards are used. First, all explanatory variables are lagged relative to the main outcomes. Second, firm fixed effects absorb time-invariant differences in managerial quality, sectoral position, and historical business model. Third, year effects absorb macroeconomic shocks and market-wide changes in innovation sentiment. Fourth, a control function is estimated using lagged local R&D tax credit shifts and lagged segment-level disclosure shocks as predictors of coherence. The intuition is that regional and segment-level changes can alter the cost and salience of innovation-related coordination without directly determining the focal firm's next-year value after fixed effects and controls. Residuals from the first-stage coherence equation are then added to the second-stage outcome equation. The residual term is statistically small in most specifications, suggesting that severe endogeneity is not dominating the main estimates.

A dynamic panel specification is also estimated to account for persistence in firm value:

$$\begin{aligned}\ln(Q_{i,t+1}) = & \delta \ln(Q_{it}) + \beta_1 C_{it} + \beta_2 I_{it} \\ & + \gamma' Z_{it} + \eta_i + \tau_t + \varepsilon_{i,t+1}.\end{aligned}\quad (4.6)$$

This model is estimated using a system-GMM procedure with collapsed instruments and restricted lag depth to limit instrument proliferation [22]. The dynamic approach is not treated as the primary estimate because it is more parameter-sensitive, but it provides a useful check on whether the main coherence effect survives after incorporating persistence explicitly.

A final methodological issue concerns the distinction between coherence and mere consistency of language. Firms can use repetitive innovation language without changing the underlying allocation of resources or outputs [23]. To address this, placebo models replace the multidimensional coherence measure with a text-only consistency measure based on the serial stability of innovation rhetoric [24]. If rhetoric alone drove the results, the placebo should perform similarly. A weaker or null placebo effect would support the argument that alignment across multiple domains, rather than stylistic stability alone, underlies the main findings [25].

5. Results

The baseline fixed-effects models reveal a positive and statistically reliable association between innovation coherence and next-year firm value. In the simplest specification including only coherence, innovation intensity, and the standard control set, the coefficient on coherence is 0.132 with a clustered standard error of 0.041. The estimate remains stable when additional controls for analyst coverage, prior stock return, and non-innovation strategic language are added, yielding a coefficient of 0.126. Moving from the 25th percentile to the 75th percentile of coherence corresponds to an estimated 6.8% increase in next-year Tobin's Q, holding other variables constant. Innovation intensity itself is positive but weaker, with a coefficient of 0.037 that is only marginally significant. The contrast implies that aligned innovation matters more consistently than high innovation level alone.

The growth regressions tell a similar story. Coherence predicts next-year revenue growth with a coefficient of 0.028, implying that a one-standard-deviation increase in coherence is associated with approximately 1.9 percentage points higher sales growth in the following year. This effect is moderate rather than dramatic, which is consistent with the expectation that innovation investments diffuse into performance gradually and imperfectly. In the cash-flow volatility models, the coefficient on coherence is negative, at -0.019, indicating that aligned innovation systems are associated with slightly lower subsequent operating volatility. The volatility result is not so large as to suggest that coherent innovators become safe firms; rather, it suggests that coherence reduces avoidable instability around innovation execution and stakeholder expectations.

The moderation analyses are informative. The interaction between coherence and competition is positive, while the interaction between coherence and squared competition is negative [26]. The point estimates are 0.164 and -0.147, respectively, both statistically distinguishable from zero at conventional levels. The implied peak occurs at a moderate competition level near the center of the observed distribution [27]. Substantively, the result suggests that coherence is least valuable when competition is very weak, because the urgency to operationalize alignment is limited, and again less valuable when competition is very intense, because private rents and strategic breathing room are compressed [28]. Under moderate competition, however, firms appear able to convert coherence into advantage without immediately dissipating its returns.

The knowledge concentration interaction is negative. A one-standard-deviation increase in concentration reduces the marginal effect of coherence on value by roughly one-fifth. This is a meaningful result because it supports the distinction developed earlier between disciplined alignment and restrictive narrowness. Firms do not benefit merely by reducing internal variance at any cost. Rather, they benefit when their innovation domains are aligned while preserving enough search breadth to support recombination and adaptation. Highly concentrated inventive portfolios are not uniformly harmful in the data, but they weaken the value contribution of coherence. The interpretation is that coherence built on a narrow knowledge base may be easier to communicate, yet less robust strategically.

Prior innovation reputation strengthens the coherence effect. The interaction coefficient is 0.049, with a standard error of 0.023. For firms one standard deviation above the mean in reputation, the marginal effect of coherence on firm value is roughly 38% larger than for firms one standard deviation below the mean. This is consistent with the idea that coherent signals are filtered through accumulated beliefs about whether the firm can actually execute innovative strategies. Reputation does not substitute for coherence; rather, it makes coherence more believable and therefore more valuable [29].

The mediation results support, but do not exhaust, the proposed mechanism. Coherence predicts next-year innovation conversion efficiency with a coefficient of 0.116. Conversion efficiency in turn predicts firm value with a coefficient of 0.221 when coherence remains in the model. The bootstrapped indirect effect equals 0.026 with a 95% interval that excludes zero. Approximately 24% of the total coherence effect on firm value appears to operate through improved conversion efficiency. That proportion is plausible. It indicates that some of the value of coherence arises because aligned firms convert innovation effort into output more effectively, while the remainder likely reflects interpretive credibility, reputation reinforcement, and reduced uncertainty.

Additional analyses help clarify the economic meaning of the effect [30]. When coherence is partitioned by domain pairings, the strongest pairwise alignment components are between disclosure and commercialization output, and between R&D commitment and environmental innovation. This pattern suggests that two forms of consistency matter especially strongly: the consistency between what firms say and what they bring to market, and the consistency between what firms fund internally and how those funds shape the environmental direction of innovation. The pairwise decomposition does not overturn the main index, but it indicates that some forms of misalignment are more salient than others.

The magnitudes remain moderate throughout. No specification produces implausibly large returns to coherence, and the effect is not universal across all outcomes. For example, coherence is only weakly related to short-horizon gross margin change, which is unsurprising because many innovation programs require time before pricing power or cost benefits become visible. The evidence therefore supports a measured interpretation. Innovation coherence is not a singular determinant of performance, but it is a systematically relevant property of the innovation system that helps explain differences in valuation and growth across otherwise comparable firms.

6. Robustness and Additional Analyses

A sequence of checks was conducted to assess whether the main results were driven by measurement choice, selection, or omitted trends. First, the coherence measure was replaced with two alternatives. The first alternative used the inverse coefficient of variation across the four innovation domains. The second used cosine similarity between the firm's innovation vector and the firm-specific rolling mean innovation vector over the prior three years [31]. Both alternatives produced positive coherence effects on next-year firm value, with coefficients of 0.109 and 0.103, respectively. The baseline formulation remained slightly stronger and more stable, suggesting that the centering-matrix construction captures alignment efficiently without being overly sensitive to extreme values.

Second, the dynamic panel estimator confirmed the main effect. In the system-GMM specification, the lagged dependent variable was strongly significant, as expected, with a coefficient of 0.611. Even after accounting for this persistence, innovation coherence retained a positive coefficient of 0.118. The Hansen test and serial-correlation diagnostics did not indicate obvious overidentification failure or second-order autocorrelation [32]. While any dynamic panel estimate should be interpreted cautiously, the result suggests that the fixed-effects findings are not an artifact of omitting value persistence.

Third, a matched-sample exercise was performed. Firms in the top tercile of coherence were matched to firms in the bottom tercile on size, leverage, age, innovation intensity, profitability, and industry-year. In the matched sample, high-coherence firms still exhibited 5.9% higher next-year firm value and 1.5 percentage points higher sales growth. The matched analysis is useful because it compares firms with similar average innovation level but different degrees of alignment. The persistence of the effect after matching supports the claim that coherence contains information not reducible to overall innovativeness.

Fourth, placebo tests reduce concern that the findings are driven merely by repetitive managerial rhetoric. A serial consistency measure based only on year-to-year stability of innovation language was small and statistically unstable in the value regressions. Likewise, a coherence measure constructed from non-innovation strategic terms showed no reliable relationship with the main outcomes. These placebos suggest that the results do not arise from firms sounding steady or professionally polished in general. The relevant signal is the cross-domain alignment of innovation itself [33].

An additional heterogeneity analysis examined whether the coherence effect differed between firms with high and low internal commercialization capability, proxied by prior launch success rates. The effect was stronger in the high-capability group, but it remained positive in the low-capability group [34]. This is consistent with the argument that coherence helps firms broadly, while stronger commercialization routines allow them to extract more from coherence. Another analysis tested whether environmental innovation alone explained the index. When the environmental component was removed, the coherence coefficient declined but remained positive. Thus, the environmental dimension is meaningful, yet it is one component of a broader alignment effect rather than the sole driver.

Finally, reverse-causality concerns were assessed by examining whether future value shocks predicted current coherence after conditioning on current value and controls. The coefficient was small and not statistically reliable. This does not eliminate all concerns about endogeneity, but it weakens the view that managers simply synchronize innovation signals in anticipation of already-known valuation changes. Taken together, the robustness analyses indicate that the documented association is fairly stable across estimators, alternative measures, and design choices.

The broader implication of these checks is conceptual as much as econometric. Innovation coherence appears to be a distinct organizational property rather than a thin restatement of patenting, disclosure intensity, or strategic verbosity [35]. It captures the extent to which the firm's innovation signals form an integrated pattern that can be executed internally and interpreted externally [36]. That property remains visible after multiple attempts to partial out adjacent explanations [37].

7. Conclusion

This paper examined whether the internal alignment of innovation signals matters for economic outcomes beyond the level of innovation itself. The analysis introduced innovation coherence as a multidimensional construct defined by the alignment among innovation disclosure, resource commitment, commercialization output, and environmental innovation activity. Across a panel of 418 listed firms over 2014–2023, higher coherence was associated with higher next-year firm value, faster revenue growth, and lower operating cash-flow volatility [38]. These effects remained after controlling for average innovation intensity, firm fixed effects, year effects, and a broad set of financial and narrative controls.

The evidence also clarified why coherence matters. Part of the answer lies in innovation conversion efficiency. Firms whose innovation domains move together appear better able to translate innovation-oriented spending into patents and market-facing launches. Yet the mediation analysis showed that this channel explains only part of the overall effect. The remaining portion is consistent with a credibility-based mechanism in which aligned signals reduce interpretive ambiguity and make future innovation cash flows appear more plausible. In this sense, coherence is both an operational property and an informational property.

The study further showed that the value of coherence is conditional rather than universal. Coherence is most beneficial under moderate competitive pressure, where firms face enough urgency to execute but not such intense rivalry that innovation rents are immediately eroded. Coherence is also more valuable when firms possess an existing reputation for innovation, suggesting that stakeholders interpret current alignment through the lens of accumulated credibility. By contrast, the gains from coherence diminish when inventive activity becomes too narrowly concentrated [39]. This result is important because it separates productive alignment from brittle specialization.

These findings have implications for managerial practice [40]. Managers often debate whether innovation communication should lead resource allocation or whether commercialization should simply follow the strongest technical opportunities. The present results suggest that neither fragmented sequencing nor rhetorical overreach is ideal. The economically favorable pattern is one in which communication, investment, technical effort, market launch, and environmental direction are synchronized sufficiently to reinforce one another. That synchronization need not imply rigid uniformity, but it does imply discipline in how the innovation program is designed and narrated.

Several limitations remain [41]. The setting is restricted to public firms and therefore emphasizes market-visible innovation systems. Private firms, young ventures, and highly projectized organizations may exhibit different coherence dynamics. The environmental innovation measure, while multidimensional, still relies on observable disclosures and outputs rather than internal process data [42]. The mediation analysis is also interpretive rather than fully causal [43]. These limitations indicate that the concept of innovation coherence should be extended to contexts where project-level timing, alliance structures, and internal governance can be observed more directly.

Even with these limits, the study points to a useful reorientation in innovation research. Innovation is often evaluated by asking how much a firm invents. An equally important question is whether the firm's innovation domains fit together in a way that stakeholders can trust and organizations can execute. The findings indicate that firms are not rewarded only for more innovation; they are also rewarded for innovation that is internally consistent, externally legible, and strategically organized. That distinction is analytically modest, but empirically meaningful.

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