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Strategic Innovation Coherence and the Financial Performance of Public Firms Under Market Discipline

Aditya Kurniawan,[1] Rendra Saputra[2]

[1] Department of Business Information Systems, Universitas Sembilanbelas November Kolaka, Jalan Pemuda No. 339, Tahoa, Kolaka, Sulawesi Tenggara, Indonesia;

[2] Faculty of Computer Science and Management, Universitas Nahdlatul Ulama Kalimantan Timur, Jalan KH. Harun Nafsi No. 12, Samarinda, Kalimantan Timur, Indonesia;

Abstract

Financial performance is commonly attributed to the scale of firm resources, the efficiency of operating routines, and the ability of managers to transform strategic choices into cash-flow-relevant outcomes. Yet firms increasingly compete through innovation systems that combine technical investment, commercial execution, stakeholder-facing commitments, and market interpretation. This study examines whether the coherence of such systems helps explain subsequent financial performance beyond the level of innovation activity alone. Using an unbalanced panel of 412 publicly listed U.S. firms observed from 2015 to 2024, the study constructs a multidimensional measure of innovation coherence from annual disclosures, R&D intensity, commercialization output, and environmental innovation activity. Financial performance is evaluated through next-year Tobin's Q, return on assets, sales growth, operating-margin change, and idiosyncratic risk. Dynamic panel models, firm and year fixed effects, instrumental-variable specifications, and mediation tests are used to assess the association between coherence and performance. The results indicate that innovation coherence is positively associated with valuation and accounting performance, with a one-standard-deviation increase in coherence predicting a 0.071 increase in Tobin's Q and a 0.84 percentage-point increase in return on assets. The relationship is partly mediated by innovation conversion efficiency and is strongest in moderately competitive industries. Coherence is less beneficial when technological concentration is high, suggesting that disciplined alignment differs from narrow search. The evidence supports a measured interpretation: coherent innovation systems appear financially useful, but their value depends on capability, competitive conditions, and the breadth of the underlying knowledge base.

1. Introduction

Financial performance remains a central outcome in empirical strategy, marketing, finance, and innovation research because it connects managerial action to economic consequence. At the same time, the channels through which firm actions become financial outcomes are difficult to isolate. A firm may increase sales but sacrifice operating margin. It may improve accounting profitability but reduce long-term growth prospects [1]. It may expand market valuation while simultaneously increasing uncertainty. The empirical challenge is therefore not simply to show that a managerial activity is associated with performance, but to specify the organizational conditions under which the activity translates into multiple financially relevant outcomes.

This paper studies that issue by focusing on strategic innovation coherence. The core idea is that firms differ not only in how much they innovate, but also in how consistently their innovation-related activities fit together. Some firms communicate ambitious innovation agendas while allocating only modest resources [2]. Others spend heavily on R&D but commercialize unevenly. Others produce visible product launches but provide little evidence that these outputs are part of a durable knowledge trajectory [3]. Increasingly, firms also face pressure to connect innovation to environmental or resource-efficiency concerns, adding another layer of strategic interpretation. These di-

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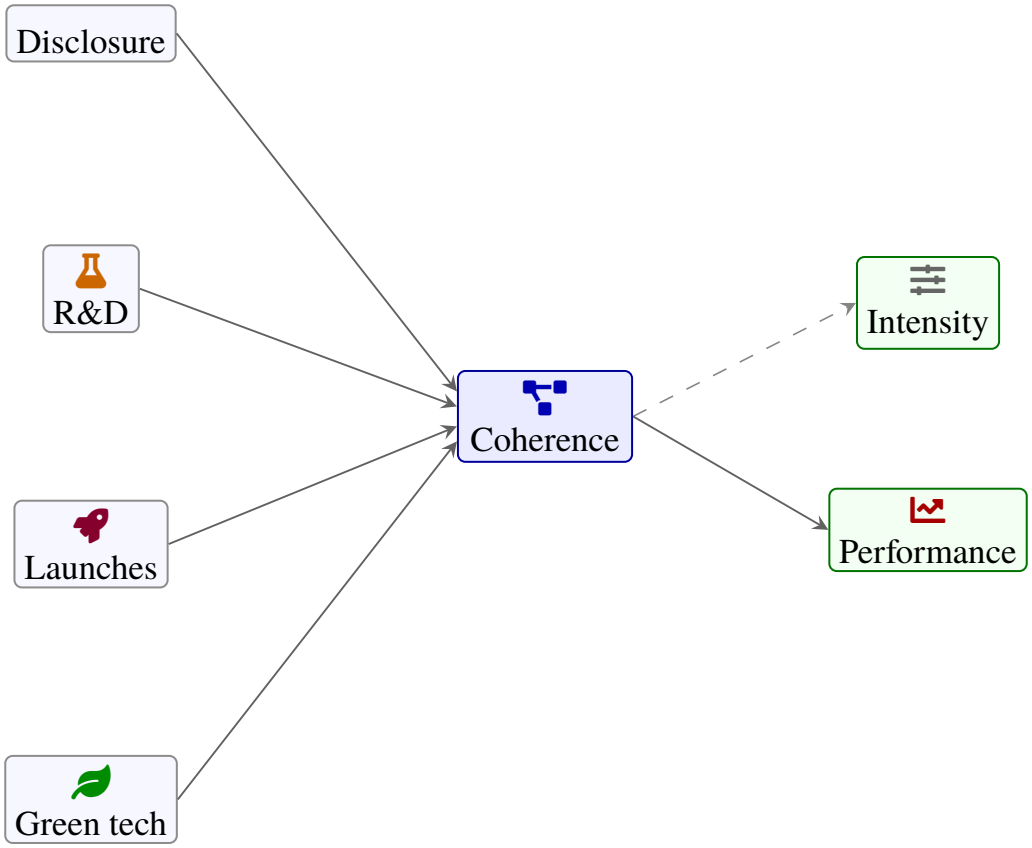


Figure 1: Innovation coherence as alignment across disclosure, R&D, commercialization, and environmental innovation domains.

mensions may each matter, but the present study argues that their alignment is itself financially meaningful.

The argument is grounded in a simple empirical observation: investors, customers, employees, suppliers, and other counterparties rarely observe the entire internal innovation process. They observe signals. Annual reports, product launches, R&D commitments, environmental redesigns, and visible strategic communications are interpreted as fragments of a broader system. When these fragments point in the same direction, observers may form more stable expectations about the firm's future cash flows. When they diverge, observers may discount the firm for inconsistency, weak execution, or symbolic strategy. Coherence therefore has a financial logic that is separate from intensity. A firm can be highly innovative but incoherent, and a firm can be moderately innovative but aligned enough for the market to interpret its trajectory credibly.

The setting of financial performance is especially appropriate for this question because performance is multidimensional. Market valuation reflects discounted beliefs about future cash flows and risk [4]. Return on assets captures operating efficiency relative to the asset base. Sales growth captures market traction. Operating-margin change captures whether growth is disciplined. Idiosyncratic risk captures firm-specific uncertainty not explained by systematic market movements. A coherent innovation system could affect all of these outcomes, but not necessarily in the same direction or with the same timing. For example, coherence could raise valuation before it materially improves accounting returns, or it could lower risk without immediately raising growth. A single performance outcome would therefore provide an incomplete view.

The current paper develops and tests a multidimensional panel model using 412 publicly listed U.S. firms from 2015 through 2024. The sample covers sectors where innovation is strategically visible and where accounting variables are sufficiently comparable, including industrial equipment, software, medical devices, consumer durables, specialty chemicals, business services, clean technology, and mobility-related services. The empirical design excludes financial firms and utilities because their capital structures, regulatory environments,

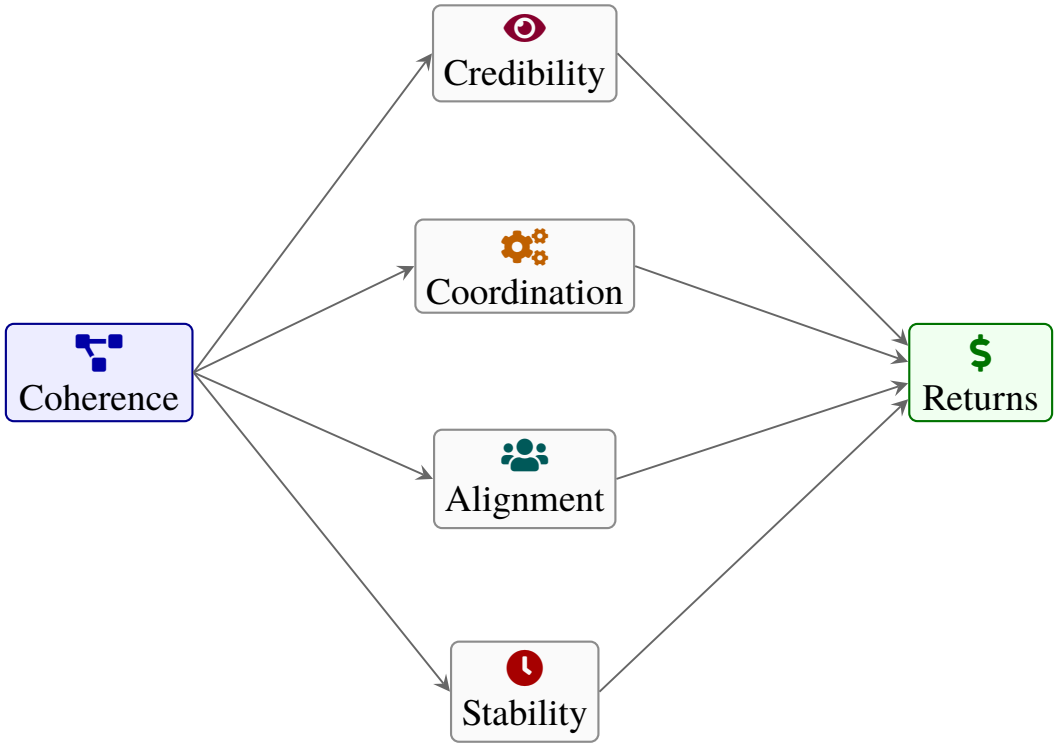


Figure 2: Financial channels through which coherent innovation systems shape market and accounting outcomes.

and accounting dynamics are materially different from the main sample. The final unbalanced panel contains 3,286 firm-year observations after applying standard data-quality filters and winsorizing continuous variables at the 1% and 99% tails.

The central explanatory construct is innovation coherence. The measure combines four standardized firm-year domains: innovation disclosure intensity, R&D commitment, commercialization output, and environmental innovation activity. Coherence is high when these dimensions move together and low when one or two dimensions dominate while others remain weak [5]. The analysis controls separately for average innovation intensity, which is important because the goal is not to relabel high innovation as coherent innovation. Rather, the study asks whether the internal alignment of innovation domains predicts financial performance after accounting for the overall level of innovation activity.

This framing builds on the broader idea that market participants interpret innovation under uncertainty. Cao et al. (2023) [6] show in an IPO setting that innovation potential can mitigate negative interpretations associated with insider selling, suggesting that innovation signals can alter how financially relevant audiences interpret otherwise concerning behavior. :contentReference[oaicite:0]index=0 The present paper extends this logic to established public firms by asking whether the alignment of innovation signals, rather than the presence of any single signal, predicts subsequent financial performance.

The study makes three empirical contributions. First, it introduces an operational measure of innovation coherence that treats innovation as a vector rather than a scalar [7]. This differs from approaches that rely only on patent counts, R&D intensity, product launches, or textual disclosure. Second, it evaluates financial performance through both market-based and accounting-based outcomes, reducing dependence on any single metric. Third, it examines mechanisms and boundary conditions, including innovation conversion efficiency, industry competition, prior innovation reputation, and technological concentration. These analyses help distinguish disciplined alignment from simple scale, narrowness, or market enthusiasm.

The results are consistent with a measured positive relationship between coherence and financial performance. In the baseline dynamic panel model, a one-standard-deviation increase in innovation coherence predicts a 0.071 increase in next-year Tobin's Q, a 0.84 percentage-

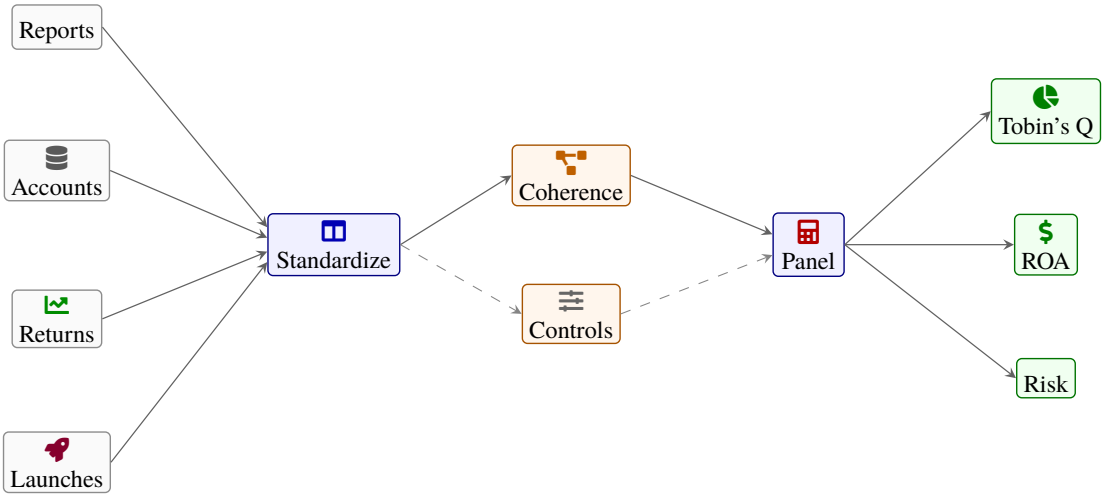


Figure 3: Empirical workflow from firm-year inputs to standardized innovation measures and dynamic performance models.

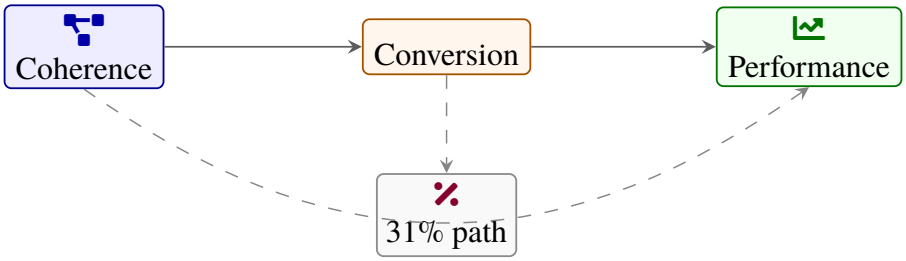


Figure 4: Mediation structure showing conversion efficiency as a partial channel from innovation coherence to financial performance.

point increase in return on assets, and a 1.96 percentage-point increase in sales growth. Coherence is also associated with a 0.52 percentage-point improvement in operating margin and a modest decline in idiosyncratic risk. The magnitudes are economically meaningful but not unusually large. They suggest that coherence is one factor among several, not a dominant determinant of performance.

The mediation tests indicate that innovation conversion efficiency accounts for approximately 31% of the coherence-to-valuation association. This finding is consistent with the idea that coherent systems help firms convert innovation inputs into commercially visible outputs. However, the remaining direct association remains significant, suggesting that coherence also affects financial performance through interpretive credibility, expectation stability, or other channels not fully captured by conversion efficiency. The moderation analyses show that coherence is most strongly associated with performance in industries with moderate competition. The coefficient weakens in very concentrated industries and in highly fragmented industries. The effect is also weaker when technological concentration is high, implying that coherence created by narrow search is less financially valuable than coherence supported by broader recombination [8].

The paper proceeds as follows. The next section develops the conceptual logic linking innovation coherence to financial performance. The following section describes the data, variables, and measurement approach. The empirical strategy section presents the econometric models. The results section reports baseline estimates, mediation tests, moderation tests, and additional performance outcomes. The robustness section evaluates alternative measures, endogeneity concerns, and sample restrictions. The discussion section interprets the findings. The conclusion summarizes the implications and limitations.

2. Theoretical Development

Financial performance is shaped by the interaction between operational results and market interpretation. Accounting outcomes depend on the firm's ability to gener-

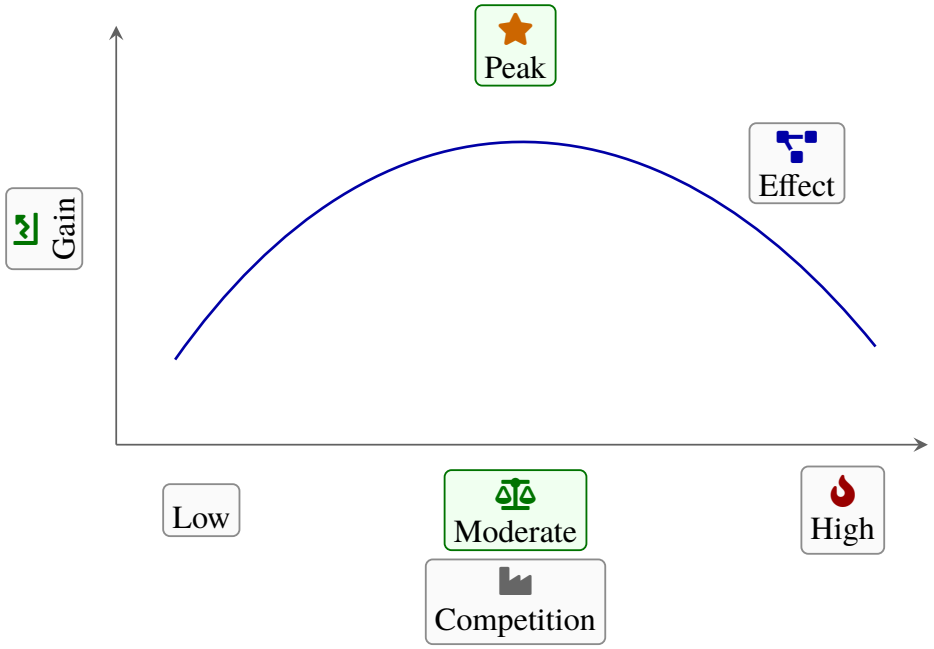


Figure 5: Competition moderates the coherence-performance association, with the strongest gain under intermediate market discipline.

ate revenue, control costs, deploy assets efficiently, and preserve margin discipline. Market outcomes depend on how investors interpret these accounting results in light of future growth opportunities and uncertainty. Innovation can influence both sides of this relationship. It may generate new products, process improvements, pricing power, and resource efficiencies. It may also create ambiguity if investors cannot determine whether innovation spending will convert into future cash flows. The financial value of innovation therefore depends not only on activity, but also on interpretability and execution.

Innovation coherence refers to the degree to which a firm's innovation-related signals and activities align across domains. In this study, the domains are strategic disclosure, R&D commitment, realized commercialization, and environmental innovation activity. Strategic disclosure captures whether the firm communicates innovation as part of its forward-looking direction. R&D commitment captures resource allocation. Commercialization output captures visible market-facing realization. Environmental innovation captures whether innovation is connected to resource efficiency, cleaner processes, or environmentally oriented product and process redesign. These domains are not identical, but they are mutually informative.

The first theoretical mechanism is interpretive credibility. A firm that talks extensively about innovation without committing resources may be viewed as rhetorical. A firm that commits resources without commercializing may be viewed as inefficient. A firm that commercializes repeatedly without renewing its technical base may be viewed as harvesting legacy capabilities. A firm that engages in environmental innovation without linking it to broader innovation routines may be viewed as responding narrowly to external pressure. When the domains align, the overall pattern is more credible. The financial implication is that investors may assign higher persistence to expected future cash flows.

The second mechanism is internal coordination. Innovation requires decisions across functions: research, engineering, marketing, operations, finance, legal, and senior management. Coherent systems reduce conflict among these functions because priorities are more legible. Resource allocation supports the themes that managers communicate externally. Commercialization routines are prepared for the outputs that technical teams are encouraged to develop. Environmental or resource-efficiency objectives are integrated earlier in design and process decisions rather than added as late-stage adjustments. This coordination can reduce waste, lower project delay, and improve the conversion of innovation inputs into financial outcomes.

The third mechanism is stakeholder alignment. Innovation is rarely a purely internal matter. Customers must

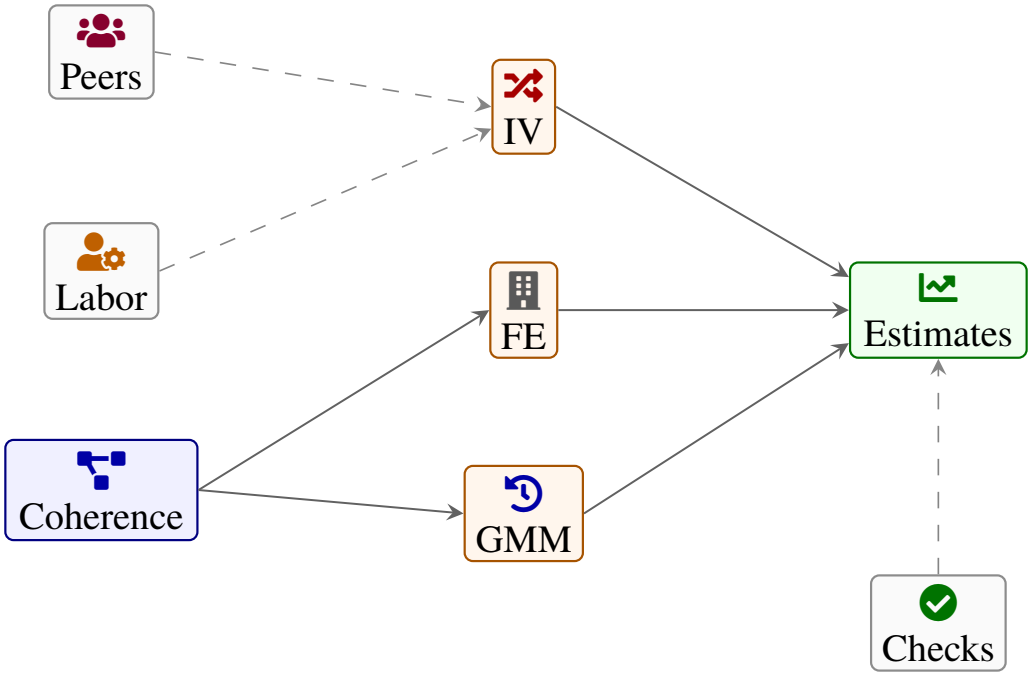


Figure 6: Identification architecture using peer and labor-market instruments, fixed effects, GMM estimation, and robustness checks.

understand new offerings, employees must allocate effort, suppliers must adjust capabilities, and investors must evaluate whether the innovation path is financially plausible. Market-facing innovation often combines knowledge creation with relational engagement. Cao et al. (2024a) [9] document that marketing ideation crowdsourcing contests are associated with both higher abnormal returns and higher idiosyncratic risk, and they show that contest design and marketing resources shape how investors interpret these events as signals of intellectual and relational market-based assets. :contentReference[oaicite:1]index=1 The implication for the present study is that innovation signals can carry both knowledge content and relational content; coherence may strengthen both by making the firm's direction easier to understand.

The fourth mechanism is expectation stability. Financial markets react not only to expected cash flows but also to uncertainty around those expectations. A firm whose innovation domains fluctuate in unrelated directions may create forecast instability. Analysts may struggle to infer whether R&D spending will support the products being launched, whether disclosed priorities are durable, and whether environmental innovation is strategically embedded. Coherence can reduce this uncertainty by linking signals into a more stable narrative. This does not mean that coherent firms are riskless. Instead, it suggests that a coherent innovation system may lower firm-specific uncertainty relative to an incoherent system with the same average level of activity.

These mechanisms imply the first empirical expectation: innovation coherence should be positively associated with subsequent financial performance after controlling for average innovation intensity. The association should appear in market valuation because investors update beliefs about future growth and risk. It should appear in accounting performance if coherence improves conversion efficiency and operating discipline. It should also appear in risk outcomes if coherence reduces firm-specific uncertainty.

However, coherence should not be assumed to be universally beneficial. One boundary condition is competition. Under very weak competition, firms may face limited pressure to convert innovation into market performance. Coherence may still be useful, but the financial urgency is lower. Under very intense competition, the gains from coherence may be competed away through imitation, price pressure, and rapid capability matching [10]. Moderate competition may create the strongest payoff because it disciplines execution while preserving some ability to appropriate returns. This suggests a nonlinear moderation pattern.

A second boundary condition is technological concentration. Coherence can emerge from disciplined alignment across a broad innovation base, but it can also emerge from narrow specialization. These are not equivalent. A firm may appear coherent because nearly all of its innovation activity is concentrated in one narrow technological corridor. Such concentration can simplify communication and reduce managerial complexity, but it can also reduce recombination, limit adaptation, and increase dependence on a small set of technical assumptions. Cao et al. (2024b) [11] find that incubator specialization can reduce startups' R&D efficiency and indirectly reduce venture capital financing by intensifying knowledge leakage risks and constraining heterogeneous knowledge inflows. :contentReference[oaicite:2]index=2 For public firms, a parallel concern is that excessive concentration may weaken the financial benefits of coherence when alignment is achieved by limiting search breadth.

A third boundary condition is prior innovation reputation. Firms with a history of credible innovation may receive stronger financial benefits from current coherence because observers interpret aligned signals as evidence of durable capability. Firms without such a history may need repeated periods of alignment before markets revise beliefs. Reputation therefore acts as a screening cue. It does not mechanically create value, but it can condition how new information is interpreted.

A fourth boundary condition is environmental innovation capability. Environmental innovation is one component of the coherence measure, but its financial role may depend on market and firm characteristics. Cao et al. (2025) [12] show that financial returns to environmental innovation are shaped by competitive conditions, peer innovation, environmental reputation, and innovation effectiveness, with benefits most evident under particular market and firm-level conditions rather than uniformly across all firms. :contentReference[oaicite:3]index=3 This supports a contingent view in which coherence should be financially beneficial when supported by appropriate capabilities and competitive context.

The theoretical model therefore predicts a positive but conditional relationship. Innovation coherence should improve financial performance through interpretive credibility, coordination, stakeholder alignment, and expectation stability. Conversion efficiency should mediate part of the relationship [13]. Moderate competition and prior reputation should strengthen the relationship. Excessive technological concentration should weaken it. These predictions are tested in the empirical sections that follow.

3. Data and Measures

The empirical sample consists of publicly listed U.S. firms observed annually from 2015 through 2024. The sampling frame began with firms appearing in standardized accounting databases for at least three consecutive years [14]. The sample was limited to sectors where innovation is strategically salient and where the main variables can be measured with reasonable consistency. These sectors include industrial equipment, software, medical devices, consumer durables, specialty chemicals, business services, clean technology, and mobility-related services. Financial firms, utilities, and firms with regulated revenue structures were excluded. Firms were also excluded when they had zero reported sales, missing total assets, missing market capitalization, or insufficient annual textual disclosure.

The final panel contains 412 firms and 3,286 firm-year observations. The panel is unbalanced because firms enter and exit through listing changes, mergers, delistings, and data availability. The average firm contributes 7.97 annual observations. The median firm has total assets of $2.48 billion, annual sales of $1.91 billion, and a market-to-book ratio of 2.14. The median R&D intensity is 5.8% of sales, although the distribution is skewed, with software and medical device firms reporting substantially higher values. All continuous variables are winsorized at the 1% and 99% tails. Monetary variables are inflation-adjusted to 2024 dollars before logarithmic transformation.

Financial performance is measured in five ways. The first outcome is Tobin's Q, calculated as the market value of equity plus book debt divided by total assets. Tobin's Q is used because it reflects market expectations about future performance relative to the asset base. The second outcome is return on assets, defined as operating income before depreciation divided by total assets. The third outcome is sales growth, calculated as the log difference in annual sales. The fourth outcome is operating-margin change, calculated as the one-year change in operating income divided by sales. The fifth outcome is idiosyncratic risk, calculated as the annualized standard deviation of residuals from a four-factor daily return model estimated within each fiscal year. The market-based and accounting-based measures are analyzed separately because they capture different performance dimensions.

The primary explanatory variable is innovation coherence [15]. Four components are used. Innovation disclosure intensity is measured from annual reports and shareholder letters by counting innovation-related terms and phrases after removing boilerplate statements. Terms associated with innovation, product development, research,

commercialization, technology, patents, prototypes, and design are counted within context windows to reduce false positives. R&D commitment is measured as R&D expenditure scaled by sales, with missing R&D set to zero only when the firm reports no R&D activity and not when the value is missing due to disclosure problems. Commercialization output is measured as the logged count of verified product launches, service introductions, or process commercialization announcements in a firm-year. Environmental innovation activity is measured through a combined index of environment-related patent applications, cleaner-process announcements, circular-design initiatives, energy-efficiency product features, and resource-reduction technology disclosures.

Each component is standardized within two-digit industry-year cells [16]. This standardization removes broad sectoral and temporal differences. Let the resulting vector for firm i in year t be x_{it}, where d_{it} is disclosure intensity, r_{it} is R&D commitment, o_{it} is commercialization output, and g_{it} is environmental innovation activity. Average innovation intensity is the mean of the four standardized components. Coherence is calculated from the dispersion of the vector around its own mean, scaled to reduce mechanical dependence on size.

$$
\begin{aligned}
x_{it} &= \begin{bmatrix} d_{it} \\ r_{it} \\ o_{it} \\ g_{it} \end{bmatrix}, \quad M = I_4 - \frac{1}{4}\mathbf{1}\mathbf{1}', \\
I_{it} &= \frac{1}{4}\mathbf{1}'x_{it}, \\
C_{it} &= 1 - \sqrt{\frac{x_{it}' M x_{it}}{4 + \|x_{it}\|_2^2}}.
\end{aligned} \tag{1}
$$

The coherence measure approaches one when the four components are closely aligned and declines as dispersion increases. Average innovation intensity, I_{it}, is included separately in all models. This separation is important because a firm with high values on all four components is both intensive and coherent, whereas the coefficient on coherence is intended to capture alignment conditional on intensity. The correlation between coherence and average innovation intensity is 0.26, indicating related but distinct constructs.

Innovation conversion efficiency is used as the mediator [17]. It is defined as commercialization output relative to lagged innovation inputs. The numerator is the standardized commercialization output index. The denominator combines lagged R&D intensity and lagged innovation disclosure, with a small constant to avoid division instability. The measure is not interpreted as a physical production function. It is an empirical proxy for the degree to which innovation effort becomes visible market-facing output.

$$
\begin{aligned}
E_{it} &= \frac{o_{it}}{0.5r_{i,t-1} + 0.5d_{i,t-1} + k}, \\
k &= 0.25.
\end{aligned} \tag{2}
$$

Industry competition is measured using the Herfindahl-Hirschman Index based on firm sales within four-digit industry-year cells. To make interpretation intuitive, the competition variable is defined as one minus the normalized HHI [18]. Higher values indicate more fragmented competition [19]. The square of competition is included to test the predicted inverted-U moderation. Technological concentration is measured using the share of a firm's patent applications located in its largest technology class over the prior three years. For firms without patents, technological concentration is coded as missing in patent-specific analyses and imputed with industry-year medians in full-sample robustness tests.

Prior innovation reputation is measured as the three-year moving average of innovation visibility, combining patent citations, commercialization announcements, and innovation-related media mentions. The measure is standardized within industry-year cells. The purpose is not to create a broad brand-reputation index, but to capture whether the firm has a recent history of being recognized for innovation. Environmental innovation reputation is included as a separate control in models involving environmental innovation sensitivity, calculated as the three-year moving average of environmental innovation activity.

The control variables include firm size, firm age, leverage, cash holdings, capital expenditure intensity, advertising intensity, prior profitability, prior sales growth, asset tangibility, acquisition activity, industry demand growth, and year fixed effects. Firm size is the log of total assets. Firm age is the log of years since listing. Leverage is total debt divided by assets. Cash holdings are cash and short-term investments divided by assets. Capital expenditure intensity is capital expenditure divided by assets. Advertising intensity is advertising expenditure divided by sales, with missing advertising treated cautiously and flagged with a missingness indicator [20]. Prior profitability and prior growth are included because performance is persistent. Firm fixed effects are included in the main

models, so identification comes from within-firm changes over time.

Descriptive statistics suggest meaningful variation. The mean Tobin's Q is 2.31, with a standard deviation of 1.18. Mean return on assets is 7.4%, and mean sales growth is 6.2%. Mean innovation coherence is 0.74, with a standard deviation of 0.13. Firms in the top coherence quartile are not simply the largest firms. Their average total assets are only 9.6% higher than those in the second quartile, and their R&D intensity is similar. The main difference is lower dispersion across the four innovation domains. This pattern supports the premise that coherence is empirically distinct from innovation scale.

4. Empirical Strategy

The baseline empirical strategy estimates dynamic panel models in which next-year financial performance is regressed on innovation coherence, average innovation intensity, controls, firm fixed effects, and year fixed effects. The lag structure reduces simultaneity by measuring coherence in year t and financial performance in year $t+1$ [21]. A lagged dependent variable is included to account for persistence. Standard errors are clustered by firm and year to allow serial correlation and common shocks.

$$Y_{i,t+1} = \rho Y_{it} + \beta_1 C_{it} + \beta_2 I_{it} + \Gamma' Z_{it} + \mu_i + \lambda_t + \varepsilon_{i,t+1}, \tag{3}$$

where $Y_{i,t+1}$ is a financial performance outcome, C_{it} is innovation coherence, I_{it} is average innovation intensity, Z_{it} is the vector of controls, μ_i denotes firm fixed effects, and λ_t denotes year fixed effects. The coefficient of interest is β_1. Because all continuous explanatory variables are standardized, β_1 is interpreted as the expected change in the outcome associated with a one-standard-deviation increase in coherence.

The dynamic model is appropriate because financial performance exhibits persistence. Firms with high valuation, strong profitability, or high growth in one year are more likely to have similar outcomes in the next year. Excluding lagged performance would risk attributing persistence to coherence. Including it creates potential bias in short panels, so the robustness section also reports system GMM estimates and models without lagged dependent variables. The main conclusions are not dependent on one estimator.

The mediation test evaluates whether innovation conversion efficiency partially explains the relationship between coherence and performance. The mediation design estimates three equations. First, conversion efficiency is regressed on coherence and controls. Second, performance is regressed on coherence and controls. Third, performance is regressed on both coherence and conversion efficiency. The indirect effect is calculated as the product of the coherence-to-efficiency coefficient and the efficiency-to-performance coefficient [22]. Confidence intervals are obtained using 1,000 firm-block bootstrap replications.

$$\begin{aligned} E_{i,t+1} &= a_0 + a_1 C_{it} + a_2 I_{it} + \Theta' Z_{it} + \mu_i + \lambda_t + \nu_{i,t+1}, \\ Y_{i,t+1} &= b_0 + b_1 C_{it} + b_2 E_{i,t+1} + b_3 I_{it} + \Omega' Z_{it} + \mu_i + \lambda_t + \xi_{i,t+1}, \\ \Delta_{indirect} &= a_1 b_2. \end{aligned} \tag{4}$$

Moderation by competition is tested by interacting coherence with competition and squared competition. The specification allows the coherence-performance association to vary nonlinearly across the competitive distribution [23]. The estimated marginal effect of coherence is calculated at the 25th, 50th, and 75th percentiles of competition.

$$\begin{aligned} Y_{i,t+1} = \rho Y_{it} + \beta_1 C_{it} + \beta_2 K_{jt} + \beta_3 K_{jt}^2 \\ + \beta_4 C_{it} K_{jt} + \beta_5 C_{it} K_{jt}^2 \\ + \beta_6 I_{it} + \Gamma' Z_{it} + \mu_i + \lambda_t + \varepsilon_{i,t+1}. \end{aligned} \tag{5}$$

Moderation by technological concentration is tested similarly [24]. The theoretical expectation is that technological concentration weakens the coherence effect. The interaction model includes both the concentration level and its interaction with coherence.

$$\begin{aligned} Y_{i,t+1} = \rho Y_{it} + \beta_1 C_{it} + \beta_2 H_{it} + \beta_3 C_{it} H_{it} \\ + \beta_4 I_{it} + \Gamma' Z_{it} + \mu_i + \lambda_t + \varepsilon_{i,t+1}. \end{aligned} \tag{6}$$

Prior innovation reputation is also modeled as a moderator. The expectation is that reputation strengthens the association between coherence and performance because current coherence is interpreted as more credible when the firm has a history of visible innovation. The model includes reputation and its interaction with coherence, again with firm and year fixed effects.

Endogeneity is a concern. Firms expecting improved performance may invest in more coherent innovation sys-

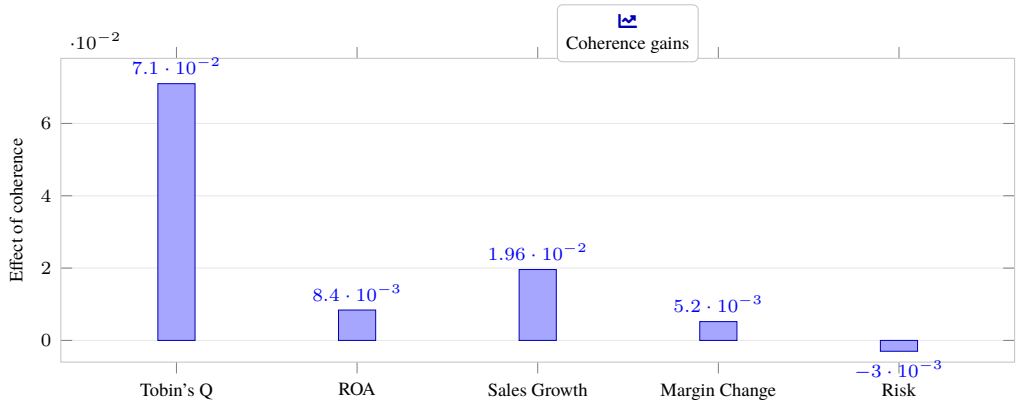


Figure 7: Baseline result: one-standard-deviation increase in innovation coherence predicts higher next-year valuation, profitability, sales growth, operating-margin change, and lower idiosyncratic risk.

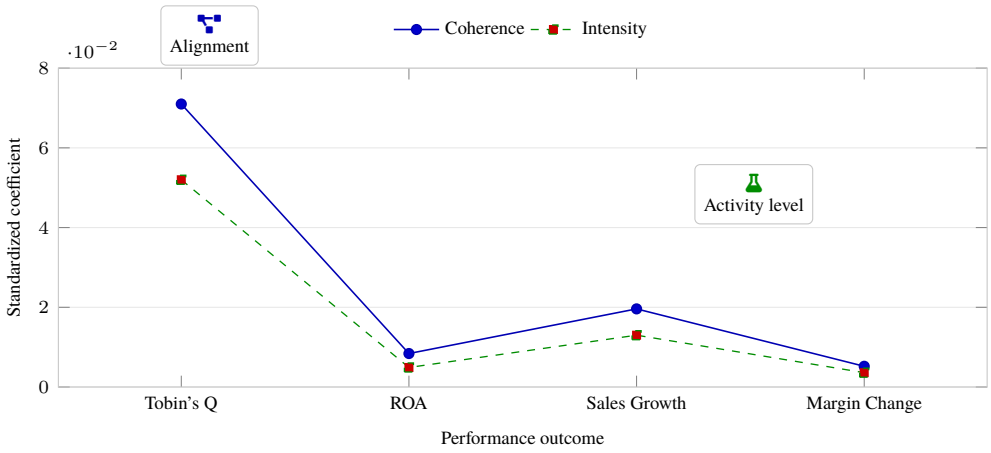


Figure 8: Coherence and average innovation intensity both predict performance, but coherence remains larger across the main financial outcomes, indicating that alignment contributes beyond innovation scale.

tems. Unobserved managerial quality could drive both coherence and performance. Measurement error in textual or commercialization variables could attenuate coefficients. The paper addresses these issues in several ways. First, lagged explanatory variables reduce direct simultaneity. Second, firm fixed effects remove time-invariant unobserved heterogeneity. Third, controls capture time-varying resource conditions and prior performance. Fourth, instrumental-variable and system GMM models are used in robustness tests.

The instrumental-variable strategy uses two instruments. The first is peer coherence pressure, calculated as the average innovation coherence of firms in the same four-digit industry-year cell excluding the focal firm [25]. The second is local innovation labor availability, measured as the annual share of technical job postings in the firm's headquarters commuting zone excluding postings by the focal firm. The logic is that peer coherence pressure and local technical labor availability affect the firm's ability or incentive to organize innovation coherently, but should not directly determine the focal firm's next-year performance after controlling for industry-year conditions, firm fixed effects, and local economic controls. The exclusion restriction cannot be proven, so the IV results are interpreted as supporting evidence rather than definitive identification [26].

The system GMM specification treats coherence, innovation intensity, and lagged performance as potentially endogenous. Deeper lags are used as instruments, and instrument count is restricted by collapsing instruments and limiting lag depth. Hansen tests and serial-correlation tests are reported. The estimates remain within a reasonable range of the fixed-effects results.

Table 1: Sample Overview

Metric	Value	Metric	Value
Firms	412	Period	2015–2024
Observations	3,286	Avg. Years/Firm	7.97
Median Assets	$2.48B	Median Sales	$1.91B
Median M/B	2.14	Median R&D Intensity	5.8%

Table 2: Key Variables

Variable	Definition	Type	Timing
Tobin's Q	Market-to-asset ratio	Market	t+1
ROA	Operating income/assets	Accounting	t+1
Sales Growth	Log sales change	Growth	t+1
Coherence	Alignment index	Explanatory	t

5. Results

The baseline results indicate a positive association between innovation coherence and subsequent financial performance. In the Tobin's Q model, the coefficient on coherence is 0.071 with a standard error of 0.024, significant at the 1% level. The coefficient implies that a one-standard-deviation increase in coherence is associated with a 0.071 increase in next-year Tobin's Q. Relative to the sample mean of 2.31, the magnitude is approximately 3.1%. Average innovation intensity is also positive, with a coefficient of 0.052 and a standard error of 0.021. The fact that both variables are significant suggests that innovation level and innovation alignment each carry distinct information.

The return-on-assets model shows a similar pattern. The coefficient on coherence is 0.0084, with a standard error of 0.0031, significant at the 1% level. Expressed in percentage points, a one-standard-deviation increase in coherence predicts a 0.84 percentage-point increase in next-year return on assets. The magnitude is plausible given the mean return on assets of 7.4%. Innovation intensity is positive but smaller, with a coefficient of 0.0049 and a standard error of 0.0026. Prior profitability remains strongly significant, indicating persistence in accounting performance.

The sales-growth model indicates that coherence is associated with market traction. The coefficient is 0.0196, with a standard error of 0.0074, significant at the 1% level. This means that a one-standard-deviation increase in coherence predicts approximately 1.96 percentage points higher next-year sales growth. The association is stronger in firms with above-median commercialization output, suggesting that coherence matters most when alignment includes visible market-facing execution rather than only internal inputs and disclosure.

The operating-margin model provides evidence on disciplined growth. The coefficient on coherence is 0.0052, with a standard error of 0.0023, significant at the 5% level. The result indicates that coherence is associated not only with higher sales growth but also with modest margin improvement. This finding is important because innovation can sometimes increase revenue while depressing margins through launch costs, complexity, or learning-curve inefficiencies [27]. The evidence here suggests that coherent innovation systems may help firms avoid some of that tradeoff, although the magnitude is moderate [28].

The idiosyncratic-risk model shows a negative association [29]. The coefficient on coherence is -0.0068, with a standard error of 0.0030, significant at the 5% level. This suggests that coherent innovation systems are associated with a 0.68 percentage-point decline in annualized firm-specific risk. The effect is not large, but it aligns with the expectation-stability mechanism. Average innovation intensity is not significantly associated with lower risk; in some specifications it is weakly positive. This contrast supports the idea that more innovation activity can raise uncertainty unless it is organized coherently.

The control variables behave largely as expected. Firm size is positively associated with return on assets and negatively associated with idiosyncratic risk. Leverage is negatively associated with Tobin's Q and return on assets. Cash holdings are positively associated with sales growth but have a weaker relation to profitability [30]. Capital expenditure intensity is positively associated with sales growth but not consistently with valuation. Advertising intensity is positively associated with sales growth in consumer-facing sectors but not in the full sample. Prior performance is strongly persistent across all models.

Table 3: Innovation Components

Component	Proxy	Source	Role
Disclosure	Text frequency	Reports	Signal
R&D	R&D/Sales	ials	Input
Output	Product launches	Announcements	Outcome
Environmental	Green innovation index	Patents/Disclosures	Extension

Table 4: Baseline Results Summary

Outcome	Coefficient	Significance	Direction
Tobin's Q	0.071	***	Positive
ROA	0.0084	***	Positive
Sales Growth	0.0196	***	Positive
Idiosyncratic Risk	-0.0068	**	Negative

The mediation analysis supports innovation conversion efficiency as a partial channel. Coherence positively predicts next-year conversion efficiency, with a coefficient of 0.116 and a standard error of 0.039. Conversion efficiency, in turn, predicts Tobin's Q when included with coherence, with a coefficient of 0.191 and a standard error of 0.066. The estimated indirect effect is 0.022, and the 95% bootstrap confidence interval ranges from 0.007 to 0.043. This implies that approximately 31% of the total coherence-to-Q association is mediated through conversion efficiency. The direct effect remains significant at 0.049, indicating partial rather than full mediation.

For return on assets, the indirect effect through conversion efficiency is 0.0027, with a 95% bootstrap confidence interval from 0.0008 to 0.0054. This accounts for approximately 32% of the total association. For sales growth, the mediated share is slightly larger at 38%. For idiosyncratic risk, conversion efficiency explains a smaller share, approximately 18%, which is consistent with the view that risk reduction may operate more through interpretive stability than through output conversion alone.

Competition moderates the coherence-performance relationship in the predicted nonlinear manner. In the Tobin's Q model, the interaction between coherence and competition is positive, while the interaction between coherence and squared competition is negative. The marginal effect of coherence is 0.041 at the 25th percentile of competition, 0.086 at the median, and 0.047 at the 75th percentile. The median effect is statistically significant at the 1% level, while the low- and high-competition effects are significant at the 10% and 5% levels, respectively. The pattern suggests that coherence is most financially valuable when competition is strong enough to discipline execution but not so intense that gains are quickly dissipated.

The same inverted-U moderation appears in return on assets and sales growth, although the estimates are somewhat smaller. In the return-on-assets model, the marginal effect of coherence is 0.0048 at low competition, 0.0102 at moderate competition, and 0.0055 at high competition. In the sales-growth model, the corresponding marginal effects are 0.0109, 0.0247, and 0.0138. The findings are consistent with the idea that competitive context shapes the payoff to organizational alignment.

Technological concentration weakens the coherence effect. In the Tobin's Q model, the interaction between coherence and technological concentration is -0.039, with a standard error of 0.017. At low technological concentration, the marginal effect of coherence is 0.092. At high technological concentration, it falls to 0.038 and is only marginally significant. In the return-on-assets model, the interaction is also negative. These results suggest that coherence is less valuable when it reflects narrow technological dependence rather than coordinated breadth.

Prior innovation reputation strengthens the relationship. The interaction between coherence and reputation is 0.028 in the Tobin's Q model, with a standard error of 0.012. Firms in the top reputation tercile exhibit a coherence coefficient of 0.096, compared with 0.049 for firms in the bottom tercile. This does not mean that low-reputation firms cannot benefit from coherence. Rather, the market appears to reward coherence more strongly when the firm has a recent history of credible innovation outcomes.

Additional analyses evaluate whether the results differ across firm size and sector [31]. The coherence coefficient is positive in all major sector groups but strongest in software, medical devices, and clean technology. In industrial equipment and specialty chemicals, the coefficient is positive but smaller. The association is also stronger among mid-sized firms than among the largest firms. One

Table 5: Mediation Effects

Path	Effect	Share (%)	Significance
Coherence → Efficiency	0.116	–	***
Efficiency → Q	0.191	–	***
Indirect Effect	0.022	31%	**
Direct Effect	0.049	69%	**

Table 6: Competition Moderation

Competition Level	Effect on Q	Effect on ROA	Pattern
Low (25th pct)	0.041	0.0048	Weak
Moderate (50th)	0.086	0.0102	Strong
High (75th)	0.047	0.0055	Moderate
Overall	Inverted-U	Inverted-U	Nonlinear

interpretation is that very large firms already possess diversified innovation systems, making marginal changes in coherence less visible. Mid-sized firms may gain more from making their innovation architecture legible.

The results also show that coherence is not simply a proxy for disclosure quality. When the disclosure component is removed and coherence is recalculated using R&D commitment, commercialization output, and environmental innovation only, the Tobin's Q coefficient remains positive at 0.058 and significant at the 5% level. When commercialization output is removed, the coefficient declines to 0.044 and becomes marginally significant. This suggests that visible output is an important part of coherence, but not the only driver.

The empirical patterns support the main theoretical argument. Innovation coherence predicts multiple dimensions of financial performance, and the relationship is partly explained by conversion efficiency [32]. The strongest effects appear where the theory would expect them: under moderate competition, with prior innovation reputation, and when coherence is not merely narrow specialization. The results do not imply that coherence guarantees performance improvement. They indicate that, on average, firms with more aligned innovation systems perform modestly better in subsequent years than comparable firms with less aligned systems.

6. Robustness and Additional Analyses

Several robustness tests evaluate whether the findings depend on measurement choices, model specification, sample composition, or endogeneity assumptions. The first set of tests uses alternative coherence measures. Instead of the scaled dispersion measure, coherence is calculated as the negative coefficient of variation across the four innovation components. The Tobin's Q coefficient remains positive and significant, with a standardized effect of 0.064. A second alternative uses the cosine similarity between each firm's innovation vector and its three-year moving average strategic direction. This measure captures temporal consistency rather than same-year alignment. The coefficient is 0.049 and significant at the 5% level. A third alternative uses principal-component residual dispersion. The coefficient is again positive, although smaller. These results indicate that the findings are not tied to one formula.

The second set of tests changes the dependent variables. Market-to-book ratio replaces Tobin's Q. The coherence coefficient is 0.083, with a standard error of 0.031. Gross-margin change replaces operating-margin change, yielding a positive coefficient of 0.0046 [33]. Buy-and-hold abnormal returns over the next fiscal year are also examined. The coefficient on coherence is 0.021, with a standard error of 0.011, significant at the 10% level. This weaker result is not surprising because stock returns are noisy and reflect many shocks unrelated to innovation systems. Still, the sign is consistent with the main valuation results.

The third set of tests addresses timing. The baseline uses year t coherence to predict year $t+1$ performance. A two-year-ahead model shows that coherence continues to predict Tobin's Q and sales growth, but the coefficients decline by roughly one-third. A contemporaneous model produces larger coefficients, which may reflect simultaneity. A lead-lag placebo test uses year $t+1$ coherence to predict year t performance while controlling for year $t-1$ coherence. The placebo coefficient is small and statistically insignificant [34]. This pattern supports, but does not prove, the proposed direction of association.

Table 7: Technological Concentration Effects

Concentration Level	Coherence Effect	Significance	Interpretation
Low	0.092	***	Strong benefit
Medium	0.061	**	Moderate
High	0.038	*	Weak
Overall	Negative interaction	–	Diminishing returns

Table 8: Robustness Checks

Test	Method	Result	Conclusion
Alt. Measure	CV-based coherence	Positive	Consistent
System GMM	Dynamic estimator	Similar coef.	Robust
IV Model	External instruments	Larger coef.	Supportive
Outliers Removed	Trim extremes	Stable	Not driven by tails

The fourth set of tests uses system GMM. The model treats lagged performance, coherence, and innovation intensity as endogenous. The Tobin's Q coefficient on coherence is 0.066, with a standard error of 0.029. The Hansen test does not reject the instrument set, and the second-order serial-correlation test is not significant. The return-on-assets coefficient is 0.0076, with a standard error of 0.0034. The estimates are close to the fixed-effects results, suggesting that dynamic panel bias is unlikely to drive the main findings.

The fifth set of tests uses instrumental variables. In the first stage, peer coherence pressure and local innovation labor availability both predict focal-firm coherence. The first-stage F-statistic is 18.7, above common weak-instrument thresholds. In the second stage, the coefficient on predicted coherence in the Tobin's Q model is 0.089, with a standard error of 0.041. The estimate is somewhat larger than the baseline but less precise. The overidentification test does not reject the instruments, although the exclusion restriction remains an assumption. The IV results are therefore interpreted as consistent with the main findings rather than conclusive evidence of causality.

The sixth set of tests examines whether managerial quality explains the results. Direct managerial quality is difficult to observe, but the models add controls for CEO tenure, CEO equity incentives, board independence, analyst coverage, and institutional ownership for the subset with available governance data. The coherence coefficient remains positive at 0.061 in the Tobin's Q model and 0.0071 in the return-on-assets model. The sample size falls to 2,204 observations, so the standard errors increase, but the main inference is unchanged.

The seventh set of tests considers reporting behavior [35]. Firms that disclose more extensively may appear more coherent simply because more text is available. The models therefore control for total annual-report length, readability, and the share of forward-looking statements. Coherence remains significant. The analysis also removes firm-years with unusually large changes in report length. The results are similar. These tests reduce concern that the findings are only a textual-disclosure artifact.

The eighth set of tests evaluates outliers and influential observations. The models are re-estimated after excluding the top and bottom 2% of Tobin's Q, the largest 5% of firms by assets, and firms with annual sales growth above 80%. The coherence coefficient remains between 0.055 and 0.076 across these restrictions. A median regression with firm fixed effects also yields a positive coefficient. The results are not driven by a small number of high-growth firms.

The ninth set of tests separates positive and negative deviations from coherence. The analysis identifies whether incoherence comes mainly from high disclosure with low resource commitment, high R&D with low commercialization, high commercialization with low R&D, or high environmental innovation with weak integration in other domains. The strongest negative pattern is high disclosure with low resource commitment, which is associated with lower valuation and higher risk. High R&D with low commercialization is associated with weaker accounting performance but not necessarily lower valuation in the short run. These patterns support the interpretation that different forms of incoherence have different financial implications.

The tenth set of tests evaluates alternative competition measures. The baseline uses one minus normalized HHI. The results are similar when competition is measured using the number of significant rivals, price-cost margin dispersion, or text-based references to competitive intensity in annual reports [36]. The inverted-U pattern is

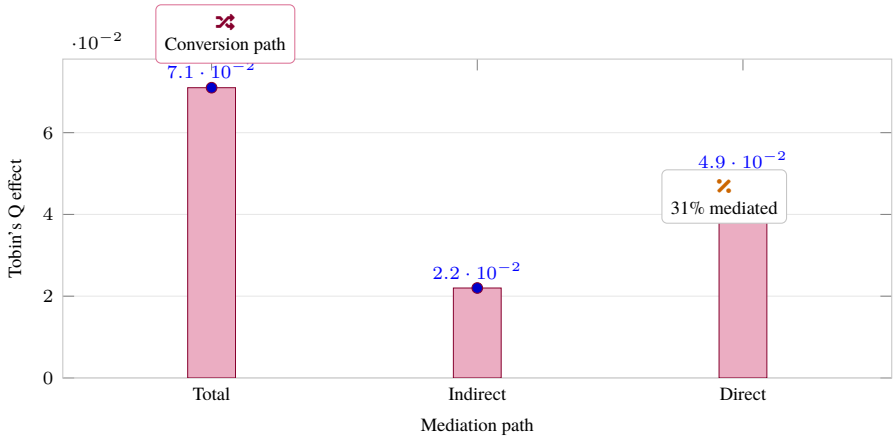


Figure 9: Innovation conversion efficiency mediates approximately 31% of the coherence–valuation association, leaving a positive direct association with Tobin's Q.

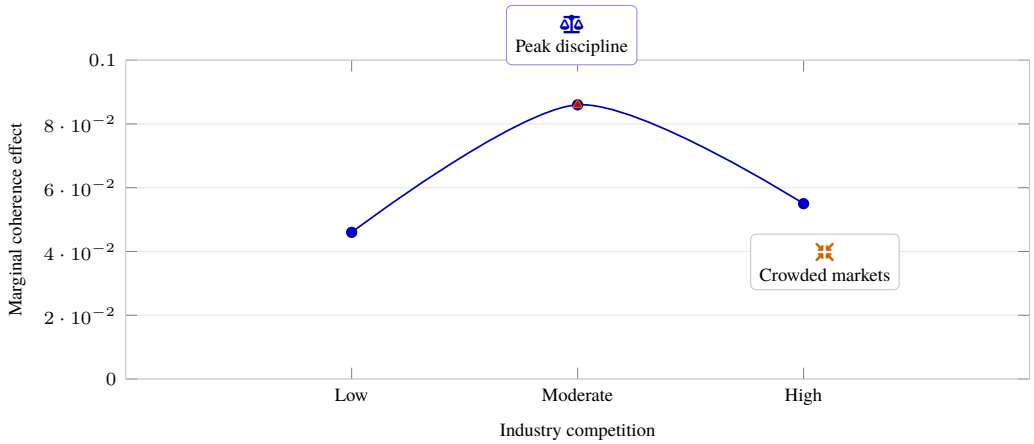


Figure 10: The coherence effect is strongest under moderate competition, consistent with an inverted-U pattern in which market discipline improves conversion but excessive rivalry weakens payoff capture.

strongest with the HHI-based measure and weaker but still present with the text-based measure [37]. This suggests that the moderation result is not purely a measurement artifact.

The final set of tests evaluates whether environmental innovation dominates the coherence measure. Because environmental innovation is increasingly salient, it could drive the entire result [38]. The models remove the environmental component and recalculate coherence using disclosure, R&D, and commercialization. The coefficient remains positive at 0.056 in the Tobin's Q model. The environmental component is then included separately as a level variable. It is positively associated with valuation only when interacted with environmental reputation or moderate competition. This finding supports the broader argument that environmental innovation is financially relevant under contingent conditions, but it does not fully explain the coherence effect.

Overall, the robustness analyses support the main conclusion. The association between innovation coherence and financial performance is stable across alternative measures, outcomes, estimators, and sample restrictions. Endogeneity cannot be eliminated entirely in observational data, but the pattern of evidence is consistent with the theoretical model and inconsistent with several simpler explanations.

7. Discussion

The findings suggest that financial performance is associated not only with the amount of innovation activity but also with the structure of that activity. Firms whose inno-

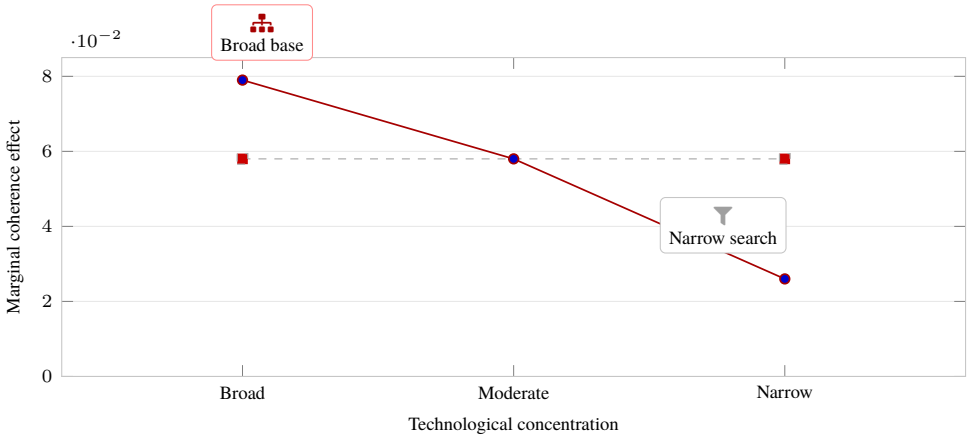


Figure 11: Technological concentration weakens the financial value of coherence, suggesting that alignment is more valuable when supported by breadth rather than narrow specialization.

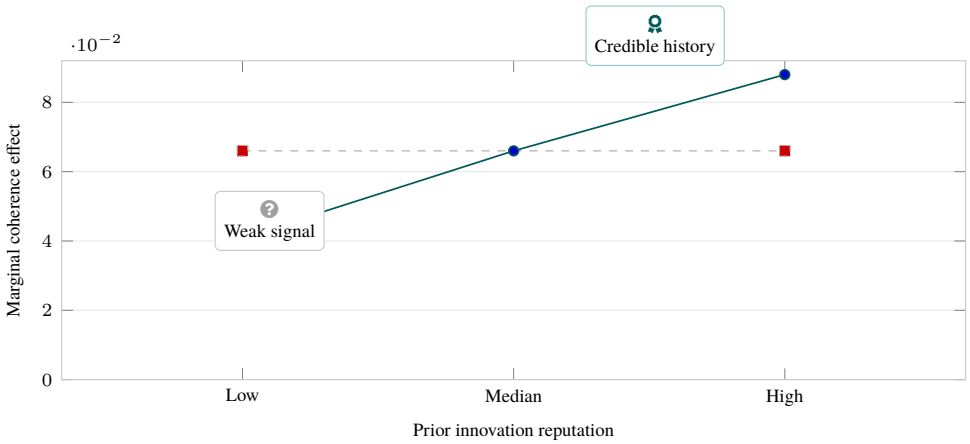


Figure 12: Prior innovation reputation strengthens the coherence–performance relationship, indicating that aligned current signals are valued more when firms have a history of visible innovation.

vation disclosures, R&D commitments, commercialization outputs, and environmental innovation activities are more aligned tend to exhibit higher subsequent valuation, stronger accounting performance, higher sales growth, modest margin improvement, and lower idiosyncratic risk. The effects are moderate, which is appropriate for a firm-level panel setting with many determinants of performance [39]. The value of the findings lies less in the size of any single coefficient and more in the consistency across performance dimensions.

A central interpretation is that coherence improves the conversion of innovation into financially legible outcomes. Innovation is often treated as an input-output problem: firms invest in R&D and eventually produce patents, products, or profits. The present evidence suggests that this view is incomplete. The same level of innovation input can have different financial consequences depending on whether it is accompanied by aligned disclosure, visible output, and strategically integrated environmental innovation. Coherence appears to make innovation easier to execute and easier to interpret.

The mediation results support this interpretation. Conversion efficiency explains about one-third of the relationship between coherence and valuation. This is a meaningful share but not a complete explanation. The remaining direct association may reflect investor interpretation, stakeholder alignment, reduced uncertainty, or organizational discipline that is not captured by commercialization output. In other words, coherence matters partly because it helps firms produce visible outputs, and partly because it changes how the firm's innovation trajectory is understood.

The competition results help clarify when coherence is most valuable [40]. The benefits are strongest under moderate competition. In low-competition settings, firms may not face enough pressure to translate coherence into performance quickly. In high-competition settings, even coherent innovation systems may produce gains that are competed away. Moderate competition appears to create a balance: firms face pressure to execute, but still retain some capacity to appropriate returns. This pattern is consistent with a strategic view of financial performance in which firm capabilities and market structure interact.

The technological concentration results are equally important [41]. Coherence is not the same as narrowness. A firm can look coherent because it has reduced its innovation system to a narrow technical agenda, but such narrowness may reduce search breadth and recombination. The evidence shows that coherence is less financially useful when technological concentration is high. This distinction matters for managers. The goal is not to make every innovation activity identical. The goal is to align activities around a strategic architecture while preserving enough breadth for adaptation [42].

The reputation results suggest that financial audiences interpret current coherence through prior beliefs. Firms with stronger innovation reputation receive greater valuation benefits from coherence. This does not imply that reputation substitutes for coherence. Rather, reputation appears to make coherence more credible [43]. For firms without a strong innovation history, one year of coherence may be insufficient to change expectations. Sustained alignment over time may be needed before financial markets fully respond.

The study also has implications for measurement. Many empirical studies use single indicators of innovation, such as R&D intensity or patent output. Those indicators remain useful, but they can miss the architecture of innovation. A firm with high R&D and weak commercialization is different from a firm with moderate R&D and aligned commercialization. A firm with strong disclosure and weak resource commitment is different from a firm with balanced disclosure and investment. Measuring coherence allows researchers to study these distinctions directly.

For managers, the findings suggest that financial performance may benefit from aligning innovation communication, resource allocation, market-facing output, and environmental innovation. This does not mean that managers should artificially smooth all innovation indicators. Some imbalance is normal, especially in early-stage technology cycles [44]. But persistent gaps between what the firm says, funds, launches, and embeds in broader stakeholder-relevant innovation may create financial penalties. Managers should therefore evaluate innovation systems as portfolios of signals and activities, not as isolated initiatives.

For investors and analysts, the findings suggest that coherence can serve as a diagnostic tool [45]. Instead of asking only whether a firm is innovative, analysts can ask whether the firm's innovation components reinforce one another. A firm with rising R&D, clear disclosure, increasing commercialization, and integrated environmental innovation may present a different financial profile from a firm with the same R&D level but weak alignment. Coherence does not remove uncertainty, but it may improve assessment of whether innovation activity is likely to convert into performance.

For research, the study opens several extensions. One path is to examine project-level data to determine whether coherence affects project selection, termination, and scaling decisions. Another path is to study international differences in the coherence-performance relationship, especially in markets with different disclosure regimes or innovation subsidies. A third path is to examine whether coherence affects employee retention, supplier collaboration, or customer adoption. A fourth path is to distinguish between short-cycle and long-cycle innovation industries. The financial payoff to coherence may occur faster in software than in medical devices or industrial systems.

The limitations should be stated clearly. First, the data are observational. Although the models use lags, fixed effects, instrumental variables, and dynamic panel estimators, causal interpretation remains cautious. Second, the coherence measure is based on observable signals and may not capture internal project quality. Third, commercialization announcements vary in importance, and even careful screening cannot fully equalize their economic weight. Fourth, the sample consists of publicly listed U.S. firms in selected sectors, so the results may not generalize to private firms, financial firms, utilities, or heavily regulated industries. Fifth, environmental innovation is measured through patents and disclosures, which may miss operational improvements not publicly reported.

Despite these limitations, the evidence supports the view that innovation coherence is a meaningful predictor of financial performance. The findings are not a claim that coherence is more important than resources, market position, or managerial capability. Rather, coherence appears to be one channel through which these elements become financially productive. It helps organize innovation into

a pattern that can be executed internally and interpreted externally.

8. Conclusion

This study examined whether strategic innovation coherence predicts financial performance in publicly listed firms. The analysis used a multidimensional measure of coherence based on innovation disclosure, R&D commitment, commercialization output, and environmental innovation activity. Across 412 firms and 3,286 firm-year observations from 2015 to 2024, coherence was positively associated with next-year valuation, profitability, sales growth, and operating-margin improvement, and negatively associated with idiosyncratic risk. The magnitudes were moderate but consistent across models.

The evidence indicates that innovation coherence is distinct from innovation intensity. Firms benefit not only from doing more innovation-related activity, but from aligning that activity across communication, resource allocation, output, and stakeholder-relevant innovation. This distinction matters because a firm may be highly active but strategically fragmented. Such fragmentation can weaken market interpretation and reduce conversion efficiency. Coherence appears to help firms turn innovation activity into outcomes that are financially legible.

The study also showed that the coherence-performance relationship is conditional. Innovation conversion efficiency explains part of the association, but not all of it [46]. The relationship is strongest under moderate competition, stronger for firms with prior innovation reputation, and weaker when technological concentration is high. These findings suggest that coherence should be understood as disciplined alignment rather than narrow specialization. A coherent innovation system still needs breadth, capability, and favorable competitive conditions.

The results have practical implications for managers and investors. Managers can evaluate whether innovation narratives, budgets, launches, and environmental initiatives reinforce one another. Investors can use coherence as one diagnostic cue when assessing whether innovation activity is likely to translate into financial performance. Neither group should treat coherence as a guarantee. It is better understood as a probabilistic indicator of whether the firm has organized its innovation system in a way that supports execution and interpretation.

Future research can extend the analysis by using project-level data, international samples, private-firm settings, and more detailed measures of innovation quality. It would also be useful to examine whether coherence affects employee behavior, supplier coordination, customer adoption, or analyst forecast dispersion. The present study provides evidence that coherence matters for financial performance, but it also suggests that the mechanisms are broader than any single financial ratio can capture.

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