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Intellectual Capital–Marketing Complementarity And Firm Performance: Evidence From Demand- And Supply-Side Outcomes

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ABSTRACT
Marketing can increase sales growth but it can also be an expense for profitability. The objective of this study was to determine under what circumstances the intensity of marketing manifests in both demand generation and profit conversion. The central construct of interest is how intellectual capital (IC) affects the translation of marketing intensity into performance. Performance was measured from two dimensions, namely profitability (ROA) on the supply side and demand side scale (lnSales). A sample comprised of unbalanced panel of Indian manufacturing firms during the period of 2014-2024 was tested the moderating effect of IC on marketing intensity. Results indicate towards a complementarity that enhances marketing to performance conversion efficiency. IC (measured as MVAIC) had positive effects on either -side performances, while marketing intensity (MKT_Int) improved demand-side sales. MI demonstrated negative relationship with profitability, until a firm had strong IC. The effect of the interaction between the two explanatory variables indicated that higher IC affected the marketing-performance outcomes, by shifting marketing-ROA slope upwards and amplifying the marketing-sales effect. Thus, the findings supported the complementarity argument, and demonstrated an outcome asymmetry that marketing effects are demand dominant and conversion to profitability is capability-dependent. The article underscores the linkage between marketing productivity and intangible capability structures and illuminates the variation in marketing efficiency attributable to firms' intellectual capital endowments.

Keywords: Intellectual capital; marketing intensity; firm performance; complementarity; demand-supply asymmetry; MVAIC; consumer research..

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1. INTRODUCTION:

Marketing, Knowledge, and Performance Outcomes

Marketing investments important in consumer research, as the means for firms to build demand and sustain market relationships. But they have a duality that inspires consumer response but pressurise margins. Importance thus lies in both the amount a firm allocates to marketing as well as its ability to translate investments into financial outcomes. According to consumer-research perspective, marketing could be understood as a strategic process of knowledge deployment in the form of market communication and customer engagement. It employs capabilities to mould market signals to into value creation. (Dekimpe & Hanssens, 2020; Hughes & Hughes, 2019).

The present paper examined this conversion aspect by separately investigating marketing's payoff as two distinct yet linked outcomes. A natural logarithm of sales (lnSales) indicates the demand-side scale, capturing consumer response and brand reach. While the supply-side profitability evaluates conversion efficiency and financial sustainability. In outcome asymmetry situations, marketing boosts sales and parallelly strains profit due to immediate-costs and late-benefits realisation. (Doraszelski & Markovich, 2008; Fischer & Shin, 2015; Huang, 2015).

Intellectual Capital as a Capability Moderator

The ability to convert marketing-driven demand into sustainable profitability depends on the ability. Intellectual capital, or IC, is an unseen infrastructure and determines the responsiveness and flexibility of the firm (Dogan and Atan, 2020; Duran and Boesso, 2023). With enhanced IC efficiency, the firms can better process market information, internal learning organisation and enhance customer linkages, which ought to aid in the translation of marketing inputs into performance (Hejazi and Ghanbari, 2016; Essel et al., 2025). Low-IC firms, in contrast, might invest in marketing without developing either absorptive or relational capacity to hold onto the value.

Complementarity theory (Brynjolfsson & Hitt, 2002; Bardhan et al., 2013) suggests that strategic resources yield beyond additive effects when used jointly rather than independently. In marketing contexts, this implies that the returns to marketing intensity rise with the firm's IC base (Homburg et al., 2022; Morgan et al., 2009). In this perspective, IC complements marketing intensity to both create demand, as well as mitigate profit erosion due to marketing costs. Such a mechanism was observed in the findings of Duran and Boesso (2023) that advertising effectiveness increases with high IC efficiency. Xu et al. (2022), also demonstrated that IC-R&D complementarities increase profitability.

Building on these insights, this study examines whether marketing and IC exhibit outcome-asymmetric

complementarity-that is, whether their joint influence differs between sales growth and profitability. Specifically, marketing intensity is expected to have a positive association with sales and a conditional (often negative) relationship with profitability, which becomes less adverse or even positive at higher IC levels. Similarly, IC's value contribution may rise with marketing exposure as market-facing learning enhances capability utilization (O'Cass & Heirati, 2015; Jang & Ahmed, 2022).

Research Contribution and Manuscript Structure

The contribution lies in integrating marketing-performance asymmetry with intellectual capital complementarity within a unified empirical framework. By distinguishing between demand- and supply-side outcomes, the study responds to calls for multidimensional marketing performance evaluation (Dekimpe & Hanssens, 2020) and extends capability-based marketing theory to account for intangible moderation effects. It adds to consumer research with evidence of that marketing productivity is partially contingent on firms' ability to organise knowledge. (Hult et al., 2004; Duran & Boesso, 2023).

Section 2 elaborates the theoretical basis and hypotheses on IC, marketing intensity, and their interaction. Section 3 describes the data, measures, and fixed-effects structure to be employed in testing within-firm complementarity. Section 4 presents findings of ROA and lnSales and discusses the conditional impact. Section 5 ends by giving theoretical, managerial, and consumer-research implications.

Literature Review and Hypothesis Development

Intellectual Capital and Firm Performance

Intellectual capital (IC) represents a package of knowledge-based assets (human, structural, and relational resources) that enhance firm efficiency transform inputs into outputs. The Value-Added Intellectual Coefficient (VAIC) and related measures have widely been applied in empirical studies to measure the efficiency in the utilization of such intangible resources by firms. Accounting performance has been linked to higher IC efficiency. Dogan and Atan (2020) and Prasojo et al. (2022), reported positive relations between IC efficiency and financial outcomes in industrial and banking domains respectively. Emerging market evidences, also supported the association, but magnitude and direction of effects differ by sector and time (Chude et al., 2023; Dumah and Gaywala, 2025; Tang, 2024).

Based on accounting metrics, IC also seems applicable to market-based outcomes. Markets appraise knowledge resources for valuation, as indicated by observations by Hejazi and Ghanbari (2016) about significant positive relationship of IC elements to Tobin Q. Findings of listed Egyptian and Indian companies also indicate that IC improves both market value and profitability (Abied El-Sharawy and El-Din El-Sharawy, 2020; Singhal et al., 2022). The relevance of IC value is indicated to persist firm acquisitions and even through crises (Lee and Atukeren, 2024; Arthur and Khindanova, 2025). Zhang et al. (2021) noticed similar trends in manufacturing sectors.

The relationship between IC and performance is nuanced in the literature. Aybars and Oner (2022) demonstrated that significance may be component-specific, wherein MVAIC contributes to the relationship with firm value. Saddam et al. (2021) reported that intangible payoffs can be negative or delayed, depending on strategy and time. This variation is in line with contingencies like industry structure, institutional quality, and measurement sensitivity (Wira et al., 2023). The role of governance and intervening mechanisms is also important. The valuation effects can be mediated by factors like earnings quality (Boonchukham et al., 2023) and the IC to value effect could be moderated by board characteristics (Bala and Hassan, 2024). Others attribute IC to the financial performance sustainability (Al-Rabei et al., 2023), its mediating effect with manufacturing sector (Essel et al., 2025), and even the varied impact of of intangible intensity on value creation, differing with levels of intangible dependence. The overall literature does consider IC as a strategic resource that could enhance profitability and facilitate market outcomes, while it is moderated by context-specific impacts.

Based on that, the hypotheses were formulated as:

$\boldsymbol{H}_1$: Intellectual Capital (IC) is related to performance outcomes.

$\boldsymbol{H}_{1a}$: IC is positively related to firm performance (ROA).

$\boldsymbol{H}_{1b}$: IC is positively related to demand-side growth (lnSales).

Marketing Intensity and Performance

Marketing-performance studies tend to distinguish demand-side (sales growth, market share) and supply-side (profitability, ROA) outcomes. One of the empirical trends is that its effects on sales are stronger and more persistent, than its effects on profits (Dekimpe and Hanssens, 2020; Hughes and Hughes, 2019). This trend favours the perspective of marketing as a long-term investment: with immediate cost and benefits realised later in the form of customer loyalty and brand equity.

The dynamic competition focus literature furthers this notion. Advertising, as strategic investment, could improve demand as well as incur costs that weaken short-run profitability (Doraszelski and Markovich, 2008). Sectoral evidence is consistent with that trade-off: lagged consumer response causes marketing to affects demand, without immediate profit (Kim and Jun, 2018; Huang, 2015). Caglar and Nisel (2017) found marketing spending exhibiting negative impact on short-term profitability, with long-run returns appearing in valuation measures. Another finding was marketing and R&D expenditure tend to strongly follow stock performance as compared to accounting profit (Sekeroglu and Karaboga, 2023).

Fischer and Shin (2015) explored the dimension of risk and indicated marketing intensity stimulate revenue with parallel increase in cash flow volatility, implying a growth-risk co-movement. Rahman et al. (2020) advocated for efficiency, rather than volume of spending, as one of the primary channels of profitability. Collectively, marketing intensity seems to be demand-expanding, but may have negative or destabilising effect

on short-term profitability depending on efficiency and timing effects.

Accordingly, the following hypotheses were tested:

H$_2$: Marketing Intensity (MKT_Int) is related to performance outcomes.

H$_{2a}$: MKT_Int is negatively related to firm performance (ROA).

H$_{2b}$: MKT_Int is positively related to demand-side growth (lnSales).

Complementarity Logic: IC as a Capability Enhancing Marketing Productivity

The payoff strategic resource may be contingent on the presence of another resource, with their combination leading to synergistic gains. This may be indicated in intangible bundles, such as IT and R&D interactions enhancing productivity and firm value (Bardhan et al., 2013; Brynjolfsson and Hitt, 2002). By the same logic, Morgan et al. (2009) asserted that marketing resources perform better when complemented by organisational capabilities for targeting and execution. Homburg et al. (2022) demonstrated the advantages of integrating digital and traditional marketing capabilities, which enhances the performance of firms.

Capability-based literature suggested moderating effects. Selling or customer-oriented capabilities, compatible with the marketing mix, moderate strategic performance (O'Cass and Heirati, 2015; Jang and Ahmed, 2022). Brand strategy could increase effectiveness of innovation towards market success (Rubera and Droge, 2013). Complementary features are also apparent in intangible investment packages. Seo and Kim (2020) noted joint effect of advertising and R&D to enhance SME performance. Similarly, IC and R&D combination may increase profitability and firm value (Xu et al., 2022). Similar interaction patterns were observed in dynamic marketing and innovation contexts (Yi et al., 2015; Hariandja, 2016; Kwon and Lee, 2024). Lin and Ho (2021) in their study on green innovation, stated marketing capability and R&D intensity jointly contribute to brand value.

In general, the literature-derived implication is that IC may serve as a competency foundation that increases marketing productivity, especially conversion efficiency, of translating marketing spending to performance gains.

The research thus put forward the following:

H$_3$: IC moderates the relationship between MKT_Int and performance outcomes.

H$_{3a}$: IC moderates the relationship between MKT_Int and firm performance (ROA).

H$_{3b}$: IC moderates the relationship between MKT_Int and demand-side growth (lnSales).

Constructs and Measurement Anchoring

The study employed Modified Value-Added Intellectual Coefficient (MVAIC) to measure IC based on human, structural, and relational capital efficiency. Its empirical applications in explaining profitability and valuations, across sectors and regions validate MVAIC (Dogan & Atan, 2020; Essel et al., 2025). Extended IC metrics add a further level of knowledge-dimensions and thus should be carefully interpreted (Pradono and Bertuah, 2022). MVAIC allows the analysis to be in line with the convention of utilising multi-component measurement (Aybars and Oner, 2022; Singhal et al., 2022). The performance is recorded on two dimensions. Return on Assets (ROA) represents supply-side efficiency turning resources into profit, and on other hand logarithmic Sales (lnSales) captures demand-side scale and growth. The log-transformation is standard in sales-response models, accommodating scale effects and enabling elasticity-based interpretations (Kim & Jun, 2018; Duran & Boesso, 2023). The intensity of marketing (MKT_Int) is determined based expenditures, and acknowledges data limitations in accounting disclosures. The advertising efficiency research lay emphasis on decoupling reporting intensity and efficiency effects (Rahman et al., 2020). Non-reporting itself may be informative firm about strategy and disclosure norms (Yurtseven & Gunalp, 2023). Based on these, the study involves a two-part marketing operationalisation, a reporting indicator and non-negative log of marketing expenditure.

Data and Methodology

Data and sample construction

The analysis employs an unbalanced panel of Indian manufacturing firms from 2014–2024 obtained from the CMIE Prowess database. Following established panel-design practices in marketing and performance studies (Dekimpe & Hanssens, 2020), the dataset was filtered to retain firms with at least six years of valid observations for key variables. This approach ensured sufficient within-firm variation to analyse the temporal effects of marketing expenditures and intellectual capital (IC). The resulting estimation samples comprised 51,392 firm-year observations (4,672 firms) for the supply-side model and 52,844 observations (4,804 firms) for the demand-side model (Table 1).

Marketing expenditure reporting was incomplete yet substantial: 67.96% of supply-sample and 67.24% of demand-sample firm-years disclosed marketing expenses. This non-reporting was included as a structural aspect of the financial disclosure and strategy that may vary systematically across firms (Rahman et al., 2020; Yurtseven and Gunalp, 2023). The panel design also facilitated testing lagged and dynamic effects, associated with marketing investment (Kaur and Singh, 2024; Li and Li, 2021).

Measures and variable construction

The performance on different dimensions was captured in two dependent variables. Return on Assets (ROA) measures efficiency on the supply-side, and ln(Sales) is an outcome scale and growth that is generally employed in marketing-performance modelling (Huang, 2015; Kim & Jun, 2018; Duran & Boesso, 2023).

The Modified Value-Added Intellectual Coefficient (MVAIC) was used to measure intellectual capital (IC). MVAIC is a generalisation of VAIC to include human, structural, and relational capital efficiency, and has had extensive use in studies relating IC to profitability and

valuation (Dogan & Atan, 2020; Pradono & Bertuah, 2022; Prasojo et al., 2022; Essel et al., 2025).

The marketing intensity (MKT_Int) was operationalised in two parts. The binary variable mktreport to show whether a firm-year reported marketing expenditures. In the case of reporting firms, MKT_Int = ln(MktExp + 1) and in the case of non-reporters, MKT_Int = 0. The specification preserves the entire panel but separates disclosure and intensity explicitly to make a significant difference in the accounting-based research of advertising (Rahman et al., 2020; Kim and Jun, 2018).

Control variables are liquidity of the firm (Net Working Capital Requirement divided by Total Assets, NWCR/TA), leverage (total debt/total assets, Lev), sales growth rate (Growth; only on the supply side), and firm size (lnTA).

Empirical strategy

Fixed-effects (FE) models were used to estimate within-firm changes in IC, marketing intensity, and performance outcomes, consistent with complementarity-based approaches emphasizing resource interactions (Bardhan et al., 2013; Duran & Boesso, 2023). Complementarity theory implies that joint deployment of resources such as IC and marketing yields synergistic performance effects (Brynjolfsson & Hitt, 2002; Morgan et al., 2009).

Two core models were estimated for both outcome variables-ROA and lnSales-corresponding to supply and demand sides.

Baseline FE model (for each outcome):

$$y_{i,t} = \beta_1 MVAIC_{i,t} + \beta_2 MKT\_Int_{i,t} + \beta_3 mkt_{report_{i,t}} + \gamma' X_{i,t} + \mu_i + \tau_t + \varepsilon_{it} \quad Eq.(1)$$

Interaction FE model (complementarity test):

$$y_{i,t} = \beta_1 MVAIC_{i,t} + \beta_2 MKT\_Int_{i,t} + \beta_3 (MVAIC_{i,t} \times MKT\_Int_{i,t}) + \beta_4 mkt_{report_{i,t}} + \gamma' X_{i,t} + \mu_i + \tau_t + \varepsilon_{it} \quad Eq.(2)$$

where $y_{i,t}$ is ROA or lnSales; $MVAIC_{i,t}$ is modified value added intellectual capital; $X_{i,t}$ includes controls for NWCR/TA, Growth, ln(TA), and Leverage; μ_i and τ_t are firm and year fixed effects.

These models were devised to test $\boldsymbol{H}_1$ ($\boldsymbol{H}_{1a}$, $\boldsymbol{H}_{1b}$), $\boldsymbol{H}_2$ ($\boldsymbol{H}_{2a}$, $\boldsymbol{H}_{2b}$), and $\boldsymbol{H}_3$ ($\boldsymbol{H}_{3a}$, $\boldsymbol{H}_{3b}$).

Moderation Interpretation: Marginal Effects

To interpret the marketing intensity and intellectual capital interaction, marginal effects were further calculated, since the interaction coefficient alone cannot tell how the slopes vary with the different levels of capability (Duran & Boesso, 2023; Homburg et al., 2022). The analysis estimated the change of the effect of one input as the other input increases, capturing complementarity between the two.

The marginal effect of marketing intensity on firm performance (dependent variable DV) can be expressed as:

$$\frac{\partial\, DV}{\partial\, MKT\_Int} = \beta_2 + \beta_3 \times MVAIC \quad Eq.(3)$$

Similarly, the marginal effect of intellectual capital can be expressed as:

$$\frac{\partial\, DV}{\partial\, MVAIC} = \beta_1 + \beta_3 \times MKT\_Int \quad Eq.(4)$$

This helps to measure the complementarity as conditional slope of one variable depends on the level of the interacting variable (Morgan et al., 2009). Margins were computed only for firms reporting marketing expenditures (mkt_report = 1) to ensure that non-disclosure is not confused with actual zero expenditure (Rahman et al., 2020; Yurtseven & Günalp, 2023). Viewed through the prism of capabilities, increasing the IC might affect the marginal productivity of the marketing expenditure, and increasing the marketing intensity might more of the performance value of IC to be put into service (Jang and Ahmed, 2022). Marginal effect reporting thus transforms the interaction term to understandable gradients at the levels of firm capability (Duran & Boesso, 2023; Homburg et al., 2022).

Robustness Checks

Robustness checks were applied to examine whether the main patterns depend on timing, persistence, or sample composition.

Lagged Marketing Models: To account for delayed effects of marketing, lagged marketing intensity variables (L1_MKT_Int) and their interactions with IC were added (Dekimpe & Hanssens, 2020; Li & Li, 2021). This addressed whether marketing effects hinge on delayed period window, a concern issue in marketing-performance context (Kaur & Singh, 2024).

Common-Sample Models: Both demand and supply equations were re-estimated using the overlapping in_both sample to ensure that differences in sample composition did not drive results (Essel et al., 2025; Costa Nossa et al., 2022).

Dynamic Fixed-Effects Models: To test stability under autocorrelation, dynamic FE models incorporating lagged dependent variables $\rho y_{i,t-1}$were estimated while acknowledging potential short-panel bias (Costa Nossa et al., 2022; Rehman & Saltik, 2023). These specifications retained all baseline and interaction terms.

2. RESULTS AND DISCUSSION

Descriptive statistics and correlation

In Table 2, Positive average profitability was observed in the supply sample (mean ROA = 0.039), while substantial dispersion was seen for demand-side scale (mean lnSales = 7.557; SD = 1.627). MVAIC varied meaningfully within firms over time (supply mean = 4.851; demand mean = 4.844), supporting its use as a time-varying efficiency proxy. Marketing intensity exhibited highly dispersion and amassed at zero because non-reporters had been coded as MKT_Int = 0 (Panel 2S mean = 1.900; Panel 2D mean = 1.869). Correlations aligned with the study's asymmetry logic: MVAIC correlated positively with both

ROA (0.2454) and lnSales (0.1720), whereas MKT_Int correlated much more strongly with lnSales (0.5002) than ROA (0.1448) (Table 3). Importantly, MVAIC–MKT_Int correlations were small (~0.06), reducing concerns that moderation reflects mechanical collinearity rather than complementarity (Brynjolfsson & Hitt, 2002; Doğan & Atan, 2020).

Demand-side and supply-side outcome asymmetry

In the base ROA model (Table 4, Panel 4S), a 1-unit increase in MVAIC is associated with a +0.0087 change in ROA (≈ +0.87 percentage points). Relative to mean ROA (3.9%), this is economically large. Marketing intensity is near zero and insignificant (−0.0001), implying no stable average profitability slope for marketing when complementarity is not modelled (Costa Nossa et al., 2022; Rehman & Saltik, 2023).

In the lnSales model (Table 4, Panel 4D), MVAIC is 0.0210, meaning a 1-unit increase in MVAIC is associated with roughly +2.1% higher sales. MKT_Int is 0.0530, implying that a 10% increase in marketing spend (≈ +0.10 in ln(MktExp + 1)) is associated with about +0.53% higher sales consistent with marketing as a driver of demand (Dekimpe & Hanssens, 2020; Doraszelski & Markovich, 2008).

When the interaction (IC × marketing) is included, both outcomes show positive complementarity. For ROA, MVAIC remains strongly positive (0.0082), marketing turns negative and significant (−0.0021), and the interaction is positive (+0.0003). For lnSales, both MVAIC (0.0170) and marketing (0.0370) stay positive, and the interaction is positive (+0.0027). This asymmetry indicates that marketing is consistently demand-enhancing but can reduce margins unless firms possess high IC to convert spend into profitable output (Abied El-Sharawy & El-Din El-Sharawy, 2020; Chude et al., 2023; Dumah & Gaywala, 2025; Saddam et al., 2021).

With the interaction model, the conditional slopes show that IC raises marketing's profitability gradient.

On Supply side (ROA): $\frac{\partial \text{ ROA}}{\partial \text{ MKT\_Int}} = -0.0021 + 0.0003 \cdot \text{MVAIC}$;

On Demand side (lnSales): $\frac{\partial \text{ lnSales}}{\partial \text{ MKT\_Int}} = 0.0370 + 0.0027 \cdot \text{MVAIC}$

Thus, IC shifts the marketing–ROA slope upward by 0.0003 ROA points for each 1-unit increase in MVAIC. The implied break-even MVAIC for marketing's ROA slope is about 7 (0.0021/0.0003), implying that marketing remains negative for most firms but becomes less negative as IC rises. IC increases the marketing elasticity of sales. The conditional slope of MVAIC ≈ 4 is 0.0478 (0.037 + 0.0108). In other words, a 10 percent rise in marketing spending is associated with about 0.48 percent rise in sales in that capability level. The direction is important as increased IC systematically steepens the returns of marketing, which is in line with the capability-based complementarity arguments (Morgan et al., 2009; Kaur and Singh, 2024; Essel et al., 2025).

Conditional margins reinforce this interpretation. On the supply side (Table 5, Panel 5S), marketing's marginal effect on ROA is negative at low IC but converges toward zero as IC rises: from $-0.0011 \rightarrow -0.0007 \rightarrow -0.0002$. The key nuance is not the exact point estimates, but the monotonic flattening by which IC dampens the profitability penalty of marketing. Symmetrically, IC's marginal effect strengthens with higher marketing. ∂ ROA / ∂ MVAIC increases ($0.0082 \rightarrow 0.0095$) with marketing intensity, indicating that marketing activates the profitability value of IC .

For lnSales(Table 5, Panel 5D), complementarity is clearer and uniformly positive. Both effects are positive and mutually reinforcing, showing that IC amplifies the responsiveness of sales to marketing intensity ($0.045 \rightarrow 0.048 \rightarrow 0.052$). Interpreting as elasticities, a 10% increase in marketing spend is associated with +0.45% sales at low IC versus +0.52% at high IC. Parallelly, IC's marginal effect increases with marketing: ($0.017 \rightarrow 0.028$) across MKT_Int, implying that a 1-unit increase in MVAIC predicts +1.7% higher sales at low marketing but +2.8% at high marketing). Together, the margins show mutual reinforcement: IC raises the returns to marketing, and marketing raises the payoff to IC, but with different implications for profitability versus sales. (Duran & Boesso, 2023; Fischer & Shin, 2015; Homburg et al., 2022).

Lagged marketing and conditional effects

Lagged marketing tests whether performance payoffs shift when marketing is treated as an investment with delayed effects (Huang, 2015; Li & Li, 2021).

For ROA (Table 6, Panel 6S), the lag-interaction model preserves the same asymmetry as before: lagged marketing is negative (-0.0022) and the interaction positive (+0.0005). The implied break-even MVAIC (approximately 4.4) suggests that profitability gains emerge with delay once IC is strong enough to convert marketing knowledge into efficiency (Hariandja, 2016; Rehman & Saltik, 2023). Conditional effects (Table 7) confirm this: marketing is negative at low IC and positive at high IC, implying that IC can eventually transform marketing costs into returns.

For lnSales (Table 6, Panel 6D), lagged marketing's main effect is small (0.0025) but the interaction grows (+0.0043). Hence, ($\frac{\partial \text{ lnSales}}{\partial \text{ L1\_MKT}} = 0.0025 + 0.0043 \cdot \text{MVAIC}$) is positive across IC quartiles. Demand creation remains persistently positive, but incremental lagged effects concentrate in higher-IC firms-consistent with cumulative learning (Kwon & Lee, 2024; Jung & Shegai, 2023).

The significant mkt_report coefficient (0.0720) suggests level differences for reporters but does not alter within-firm inference. Overall, lagged models confirm that IC magnifies marketing productivity over time (Arthur & Khindanova, 2025).

Robustness with common samples and dynamic FE

Sample in_both and in_supply are same, thus results were replicated for ROA and 8 shows that demand-side signs and significance remain stable when restricting to the overlapping sample. This addresses sample dependence and confirms that complementarity is not driven by

different firm compositions (Costa Nossa et al., 2022; Prasojo et al., 2022).

Table 9 introduced lagged dependent variables to capture performance persistence. Both outcomes are persistent (L.ROA = 0.196; L.lnSales = 0.452). For ROA, MVAIC remains positive (0.0080), marketing remains negative (-0.0021), and the interaction is positive (0.0003). Complementarity is thus robust after controlling for persistence (Dumah & Gaywala, 2025; Al-Rabei et al., 2023).

For lnSales, MVAIC (0.0250) and marketing (0.0270) remain positive and significant, but the interaction becomes small (0.0004). This attenuation suggests that when sales persistence is explicitly modelled, incremental moderation is absorbed by dynamic adjustment, a pattern consistent with knowledge-accumulation studies (Lee & Atukeren, 2024; Kaur & Singh, 2024). Complementarity therefore appears strongest in static and lagged specifications, while dynamic sales models highlight persistent main effects.

Overall assessment and hypothesis synthesis

Across specifications, IC (MVAIC) is consistently positive for both ROA and lnSales, supporting $\boldsymbol{H}_{1a}$ and $\boldsymbol{H}_{1b}$ (Doğan & Atan, 2020; Xu et al., 2022). Marketing intensity is robustly positive for lnSales supporting $\boldsymbol{H}_{2b}$ (Dekimpe & Hanssens, 2020; Fischer & Shin, 2015; Rahman et al., 2020). For ROA, marketing is weak in the base model but negative once complementarity is modelled and most negative at low IC, supporting $\boldsymbol{H}_{2a}$ in its conditional form (Huang, 2015; Şekeroğlu & Karaboğa, 2023). Complementarity is strongest on the supply side and in static or lagged margins: IC systematically shifts marketing's performance slope upward for ROA and amplifies marketing's sales elasticity for lnSales, supporting $\boldsymbol{H}_{3a}$ and $\boldsymbol{H}_{3b}$ with partial attenuation for $\boldsymbol{H}_{3b}$ in dynamic models (Duran & Boesso, 2023; Homburg et al., 2022; Hariandja, 2016; Kwon & Lee, 2024).

Overall, results confirm an outcome asymmetry: IC–marketing complementarity is evident for demand creation and most economically salient for conversion efficiency (ROA), where IC mitigates and under lagged timing can reverse marketing's profitability pressure (Arthur & Khindanova, 2025; Essel et al., 2025).

Conclusion

Empirical Summary and Theoretical Insights

Marketing intensity showed the expected outcome asymmetry that it increases sales (lnSales), but its relationship with profitability (ROA) is weak or negative, when IC does not moderate it. With interaction of marketing intensity and intellectual capital, the profitability slope becomes contingent, with high-IC firms having a smaller profitability pressure from marketing and becoming more conversion efficient.

This can be interpreted as capability-conditioned complementarity. Firms with greater intellectual capital seem to be in a better position to convert marketing expenditures into market growth without the same degree of margin pressure (Duran and Boesso, 2023; Homburg et al., 2022). The positive interaction implied that the overall influence of marketing and IC outweigh sum of their individual influences, which is consistent with the complementarities of organisational and intangible resource bundles (Brynjolfsson and Hutt, 2002; Bardhan et al., 2013). The lagged and dynamic specifications also indicated that the effects persisted over time, reinforcing the notion that knowledge and relational base deepen marketing productivity (Kwon and Lee, 2024; Jung and Shegai, 2023).

The findings, hence, observed outcome asymmetry is substantive. Marketing is demand-focused in the short run, and profitability results materialise when marketing intensity is combined with adequate level of intellectual capital. The financial benefits of marketing hinge on knowledge-based capability endowments (Arthur & Khindanova, 2025; Essel et al., 2025).

Implications for Consumer Research, Management, and Future Inquiry

From a consumer research perspective, the study underscored that marketing outcomes cannot be judged solely by expenditure levels or immediate sales responses. A leverage of marketing lies in its interaction with intellectual capital, in the form of competencies, which helps interpret consumer signals and act on them to retain value rather than leaking it through costs (Xu et al., 2022; Kwon and Lee, 2024). In high-IC firms, marketing efforts could more likely yield richer consumer insights and organisational learning which can be reflected in market performance and profitability.

In a managerial perspective, marketing and intellectual capital appear to be interdependent investments rather than two distinct budget lines. Effectiveness of marketing can be increased through capability-building, i.e., knowledge management and data analytics of long-term effects of marketing. (Homburg et al., 2022; Duran and Boesso, 2023). It further reinforces the argument keeping demand and supply metrics separate, allowing the managers to understand when sales growth is (or is not) turning into profitability (Dekimpe & Hanssens, 2020).

The study contributes to the dialogue between marketing and knowledge-capital literatures by testing the joint value of intangible complementarities. Future works can test the hypothesis of the nonlinearity of complementarity (thresholds), its industry-dependent nature, or relying on other capabilities measures (digital maturity or customer analytics sophistication). Structures linking the behaviour of consumers at the consumer level with firm-level measurements of IC would also be useful in uncovering micro-foundations on which market responsiveness is maintained by learning and relational capital

Overall, this study reinforces that the marketing–performance relationship is not uniform but capability-contingent. Marketing generates value most effectively when intellectual capital enables the firm to learn faster, coordinate better, and convert consumer attention into profitable outcomes.

Appendix: Empirical Results Tables

Table 1 Sample Construction and Marketing Reporting Rates

Sample flag	CID-year Observations	Firms (groups)	Marketing reporters	Reporting rate
in_supply	51,392	4,672	34,926	67.96%
in_demand	52,844	4,804	35,533	67.24%
in_both	51,392	4,672	34,926	67.96%

Notes: Sample flags at least T ≥ 6 panel observations based on non-missing core variables. Source: Authors' calculations (STATA).

Table 2 Descriptive Statistics

Panel 2S. Descriptive Statistics: Supply sample (in_supply)

Variable	N	Mean	SD	p25	p50	p75	Min	Max
ROA	49,233	0.039	0.075	0.009	0.035	0.076	-0.256	0.256
MVAIC	48,241	4.851	3.269	3.051	4.013	5.549	0.031	22.416
MKT_Int	51,392	1.900	1.995	0.000	1.411	3.285	0.000	8.194
NWCR/TA	49,442	0.127	0.222	0.010	0.124	0.259	-0.709	0.662
Growth	47,107	16.244	47.255	-4.744	8.701	25.370	-66.153	325.060
ln(TA)	49,460	7.499	1.606	6.476	7.412	8.445	3.605	12.005
Leverage	48,048	0.319	0.236	0.140	0.293	0.446	0.001	1.263

Notes: Variables winsorised at the 1st/99th percentiles within the supply sample. Source: Authors' calculations (STATA).

Panel 2D Descriptive Statistics: Demand sample (in_demand)

Variable	N	Mean	SD	p25	p50	p75	Min	Max
lnSales	50,088	7.557	1.627	6.635	7.579	8.559	2.760	11.653
MVAIC	49,180	4.844	3.270	3.047	4.008	5.538	-0.014	22.422
MKT_Int	52,844	1.869	1.988	0.000	1.361	3.246	0.000	8.185
NWCR/TA	50,467	0.127	0.224	0.010	0.124	0.260	-0.726	0.671
ln(TA)	50,489	7.479	1.615	6.460	7.397	8.430	3.481	11.997
Leverage	48,927	0.321	0.240	0.140	0.294	0.448	0.001	1.302

Notes: Variables winsorised at the 1st/99th percentiles within the demand sample. Source: Authors' calculations (STATA).

Table 3 Correlation matrix

Panel 3S. Correlation (Supply sample)

	ROA	MVAIC	MKT_Int	NWCR/TA	Growth	lnTA	Leverage

ROA	1.000	0.2454	0.1448	0.4359	0.0938	0.1343	-0.4774
MVAIC		1.0000	0.0601	0.0158	0.1310	0.1557	0.0524
MKT_Int			1.0000	0.0377	-0.0296	0.4974	-0.1607
NWCR/TA				1.0000	-0.0162	-0.0560	-0.4755
Growth					1.0000	-0.0290	0.0296
lnTA						1.000	-0.1379
Leverage							1.0000

Notes: Significance at the 5% level. Source: Authors' calculations (STATA).

Panel 3D. Correlation (Demand sample)

	lnSales	MVAIC	MKT_Int	NWCR/TA	lnTA	Leverage
lnSales	1.0000	0.1720	0.5002	0.0214	0.8936	-0.2025
MVAIC		1.0000	0.0616	0.0158	0.1580	0.0500
MKT_Int			1.0000	0.0366	0.4976	-0.1613
NWCR/TA				1.0000	-0.0558	-0.4758
lnTA					1.0000	-0.1438
Leverage						1.0000

Notes: significance at the 5% level. Source: Authors' calculations (STATA).

Table 4 Main FE Models: Base vs Interaction Effects

Panel 4S. Supply Side FE Models (DV: ROA)

Variables	(1) Base Model	(2) Interaction Model
MVAIC	0.0087*** (0.0003)	0.0082*** (0.0004)
MKT_Int	-0.0001 (0.0004)	-0.0021*** (0.0007)
MVAIC × MKT_Int		0.0003*** (0.0001)
Mkt_report	0.0007 (0.0013)	0.0012 (0.0013)
Controls (leverage, working capital firm growth & size)	Yes	Yes
n	45,052	45,052
n	4,672	4,672
Within R²	0.294	0.295
Firm / Year FE	Yes/ Yes	Yes / Yes
Cluster	CID	CID

Notes: Significance: 1%, 5%,10% as *, **, *. p < 0.10. very small values may round to 0.0000. Source: Authors' calculations (STATA).**

Panel 4D. Demand Side FE Models (DV: lnSales)

Variables	(1) Base Model	(2) Interaction Model
MVAIC	0.0210*** (0.0027)	0.0170*** (0.0035)
MKT_Int	0.0530*** (0.0042)	0.0370*** (0.0059)
MVAIC × MKT_Int		0.0027*** (0.0009)
Mkt_report	-0.0160 (0.0120)	-0.0120 (0.0120)
Controls (leverage, working capital, & size)	Yes	Yes
n	47,755	47,755
n	4,804	4,804
Within R²	0.574	0.575
Firm / Year FE	Yes/ Yes	Yes / Yes

Cluster	CID	CID
Notes: Significance: 1%, 5%,10% as *, **, *. p < 0.10. very small values may round to 0.0000. Source: Authors' calculations (STATA).**		

Table 5 Conditional Effects IC-Marketing Interaction

Panel 5S. Conditional effects on ROA (Supply Side)

At value	**Marginal effect**
Marginal effect of marketing intensity on ROA at IC quartiles	
IC p25 (3.051)	-0.0011** (0.0004)
IC p50 (4.013)	-0.0007* (0.0004)
IC p75 (5.549)	-0.0002 (0.0004)
Marginal effect of MVAIC on ROA at marketing grid values	
MKT_Int = 0	0.0082*** (0.0004)
MKT_Int = 1	0.0085*** (0.0003)
MKT_Int = 2	0.0088*** (0.0003)
MKT_Int = 3	0.0092*** (0.0003)
MKT_Int = 4	0.0095*** (0.0004)

Notes: Margins computed from the corresponding interaction FE. Source: Authors' calculations (STATA).

Panel 5D. Conditional effects on lnSales (Demand Side)

At value	**Marginal effect**
Marginal effect of marketing intensity on lnSales at IC quartiles	
IC p25 (3.047)	0.0450*** (0.0043)
IC p50 (4.008)	0.0480*** (0.0040)
IC p75 (5.538)	0.0520*** (0.0041)
Marginal effect of MVAIC on lnSales at marketing grid values	
MKT_Int = 0	0.0170*** (0.0035)
MKT_Int = 1	0.0190*** (0.0029)
MKT_Int = 2	0.0220*** (0.0026)
MKT_Int = 3	0.0250*** (0.0026)
MKT_Int = 4	0.0280*** (0.0029)

Notes: Margins computed from the corresponding interaction FE. Source: Authors' calculations (STATA)

Table 6 Effect of Lagged marketing

Panel 6S. Lagged marketing (DV: ROA)

Variables	**(1) Lag-Base**	**(2) Lag-Interaction**
MVAIC	0.0090*** (0.0003)	0.0082*** (0.0004)
L1_MKT_Int	0.0006* (0.0003)	-0.0022*** (0.0006)
MVAIC × L1_MKT_Int		0.0005*** (0.0001)
Mkt_report	-0.0003 (0.0010)	-0.0003 (0.0009)
Controls	Yes	Yes
n	42,427	42,427
n	4,672	4,672
Within R^2	0.297	0.299
Firm / Year FE	Yes/ Yes	Yes / Yes

Notes: Significance: 1%, 5%,10% as *, **, *. p < 0.10. Source: Authors' calculations (STATA).**

Panel 6D. Lagged marketing (DV: lnSales)

Variables	**(1) Lag-Base**	**(2) Lag-Interaction**
MVAIC	0.0230*** (0.0029)	0.0170*** (0.0036)
L1_MKT_Int	0.0260*** (0.0027)	0.0025 (0.0052)
MVAIC × L1_MKT_Int		0.0043*** (0.0010)
Mkt_report	0.0720*** (0.0094)	0.0720*** (0.0094)
Controls	Yes	Yes
n	44,156	44,156
n	4,804	4,804
Within R^2	0.559	0.560
Firm / Year FE	Yes/ Yes	Yes / Yes

Notes: Significance: 1%, 5%,10% as *, **, *. p < 0.10. very small values may round to 0.0000. Source: Authors' calculations (STATA).**

Table 7 Conditional Effects (Lagged Marketing)

Panel 7S Lagged Marketing CE on ROA

At value	Marginal effect
Marginal effect of MVAIC on ROA at lagged marketing quartiles	
Lag MKT_Int p25 (0.993)	0.0087*** (0.0003)
Lag MKT_Int p50 (2.389)	0.0095*** (0.0003)
Lag MKT_Int p75 (3.820)	0.0100*** (0.0004)
Marginal effect of lagged marketing on ROA at IC quartiles	
IC p25 (3.051)	-0.0006* (0.0003)
IC p50 (4.013)	-0.0001 (0.0003)
IC p75 (5.549)	0.0007** (0.0003)

Notes: Margins computed from the corresponding interaction FE. Source: Authors' calculations (STATA)

Panel 7D. Lagged Marketing CE on lnSales

At value	Marginal effect
Panel A: Marginal effect of MVAIC on lnSales (∂lnSales/∂IC) at lagged marketing quartiles	
Lag MKT_Int p25 (0.993)	0.0210*** (0.0030)
Lag MKT_Int p50 (2.361)	0.0270*** (0.0028)
Lag MKT_Int p75 (3.798)	0.0330*** (0.0033)
Panel B: Marginal effect of lagged marketing on lnSales (∂lnSales/∂LagMKT_Int) at IC quartiles	
IC p25 (3.047)	0.0160*** (0.0029)
IC p50 (4.008)	0.0200*** (0.0025)
IC p75 (5.538)	0.0260*** (0.0028)

Notes: Margins computed from the corresponding interaction FE. Source: Authors' calculations (STATA)

Table 8 Common-sample robustness (in_both): (DV: lnSales)

Variables	(1) Base Model	(2) Interaction Model
MVAIC	0.0210*** (0.0027)	0.0160*** (0.0035)
MKT_Int	0.0520*** (0.0042)	0.0350*** (0.0059)
MVAIC × MKT_Int		0.0027*** (0.0009)
Mkt_report	-0.0160 (0.0120)	-0.0110 (0.0120)
Controls	Yes	Yes
n	46,951	46,951
n	4,672	4,672
Within R²	0.576	0.577
Firm / Year FE	Yes/ Yes	Yes / Yes

Notes: Significance: 1%, 5%,10% as *, **, *. p < 0.10. Source: Authors' calculations (STATA).**

Table 9 Dynamic Fixed-Effects Robustness

Panel 8S. Dynamic FE (DV: ROA)

Variables	(1) Dynamic Base Model	(2) Dynamic Interaction Model
L.ROA	0.1960*** (0.0097)	0.1960*** (0.0097)
MVAIC	0.0085*** (0.0003)	0.0080*** (0.0004)
MKT_Int	-0.0004 (0.0004)	-0.0021*** (0.0006)
MVAIC × MKT_Int		0.0003*** (0.0001)
Mkt_report	0.0009 (0.0012)	0.0014 (0.0012)
Controls	Yes	Yes
n	42,344	42,344
n	4,672	4,672
Within R²	0.330	0.331
Firm / Year FE	Yes/ Yes	Yes / Yes

Notes: Significance: 1%, 5%,10% as *, **, *. p < 0.10. Source: Authors' calculations (STATA).**

Panel 8D. Dynamic FE (DV: lnSales)

Variables	(1) Dynamic Base Model	(2) Dynamic Interaction Model

L.lnSales	0.4520*** (0.0140)	0.4520*** (0.0140)
MVAIC	0.0260*** (0.0021)	0.0250*** (0.0027)
MKT_Int	0.0300*** (0.0027)	0.0270*** (0.0043)
MVAIC × MKT_Int		0.0004 (0.0007)
Mkt_report	-0.0140 (0.0086)	-0.0130 (0.0087)
Controls	Yes	Yes
n	43,106	43,106
n	4,804	4,804
Within R^2	0.696	0.696
Firm / Year FE	Yes/ Yes	Yes / Yes

Notes: Significance: 1%, 5%,10% as ***, **, *. p < 0.10. Source: Authors' calculations (STATA).

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