

Market Sensing, Health Consciousness Alignment, and Marketing Performance: A Moderated Mediation Model

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ABSTRACT

Purpose – Market sensing capability shows inconsistent effects on marketing performance across prior SME studies, including Indonesia's herbal medicine sector, where firms hold rich biodiversity-based knowledge yet underperform commercially. This study tests value co-creation capability as the mediator reconciling these conflicting findings, with digital engagement capability as a boundary condition.

Design/methodology/approach – Data from 300 herbal SME owners and managers in East Java were analyzed with PLS-SEM in SmartPLS 4, complemented by CTA-PLS, the cross-validated predictive ability test (CVPAT), importance-performance map analysis, and necessary condition analysis (NCA).

Finding/Results – Market sensing capability and health consciousness alignment significantly strengthened value co-creation capability ($\beta = 0.420, 0.344; p < .001$), which significantly predicted marketing performance ($\beta = 0.483, p < .001$) and complementarily (partially) mediated market sensing capability's effect on marketing performance while fully mediating health consciousness alignment's effect. Digital engagement capability had no direct effect but significantly strengthened the co-creation-to-performance path ($\beta = 0.090, p = .003$). CVPAT confirmed predictive superiority over a naive benchmark throughout and over a linear benchmark for marketing performance and the overall model; NCA identified value co-creation capability as the strongest necessity condition.

Originality/Value – The findings offer one plausible explanation for a documented contradiction in the SME literature, consistent with value co-creation capability, rather than an unstable sensing effect, accounting for divergent prior results in this sample, and giving herbal SME managers an evidence-based investment priority.

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1. Introduction

East Java hosts one of Indonesia's densest concentrations of herbal medicine micro, small, and medium enterprises, built on a biodiversity base that few competing regions can match. Despite this endowment, herbal SMEs in the province routinely report marketing outcomes that lag behind their production capacity: limited market reach, weak brand differentiation, and heavy dependence on informal distribution channels. The paradox is striking. Firms that hold genuinely unique raw material knowledge still struggle to convert that knowledge into market performance, which suggests the missing link lies not in what these firms know about their products, but in how that knowledge is translated into marketing capability.

Marketing capability scholarship has long treated market sensing capability, the ability to detect and interpret signals from customers and competitors, as a foundational driver of superior market performance (Day, 1994; Narver & Slater, 1990). The market orientation and dynamic capabilities traditions both frame market sensing as an antecedent that should, in principle, cascade into better positioning, faster response, and ultimately stronger marketing outcomes. Empirical support for this cascade, however, has been far from uniform across firm sizes and sectors.

The inconsistency is visible when two Indonesian SME studies are placed side by side. Using a sample of 168 leather and furniture SME owners, Ardyan (2016) found that market sensing capability had no significant direct effect on SME performance, with the relationship only materializing through product innovativeness as a mediator. In contrast, Mulyana and Azka (2022), surveying 192 Muslim fashion SME leaders in Central Java, reported that market sensing capability exerted a significant direct effect on marketing performance. Same predictor, same country, same SME context, opposite verdicts. This divergence implies that the market sensing-performance link is conditional rather than universal, and that an average path coefficient estimated in isolation cannot settle the question. A missing mediating mechanism, an unmodeled moderator, or both, plausibly account for the split.

A mediating mechanism offers one way to reconcile this split. Value co-creation capability, a firm's ability to engage customers as active partners in generating product and service value (Yi & Gong, 2013; Vargo & Lusch, 2004), is tested here as the channel through which market sensing capability and health consciousness alignment reach marketing performance, with digital engagement capability (Wielgos et al., 2021) proposed as a condition that strengthens the mediator-to-performance path. The model was tested with PLS-SEM on 300 herbal SME respondents in East Java, complemented by necessary condition analysis to establish whether value co-creation capability is not just helpful on average but indispensable at a minimum threshold.

The study contributes theoretically by repositioning value co-creation capability as the mechanism that reconciles conflicting market-sensing findings in the SME literature, and practically by giving herbal SME managers a prioritized, rather than undifferentiated, set of capability investments. The next section develops the theoretical model and states the study's hypotheses.

2. Literature Review & Hypothesis Development

Two complementary theoretical lenses anchor the model. The resource-based view (RBV) holds that heterogeneous, valuable, and difficult-to-imitate resources are the source of sustained competitive advantage (Barney, 1991), and situates market sensing capability and health consciousness alignment as firm-level resources that must be converted into higher-

order capabilities to generate performance. Service-dominant logic (SDL) supplies the conversion mechanism: value is not embedded in a firm's output but co-created through interaction between the firm and its customers (Vargo & Lusch, 2004). Value co-creation capability, the firm's ability to organize and facilitate that interaction (Yi & Gong, 2013), is therefore positioned as the mediating capability that channels sensing and alignment resources into marketing performance. Digital engagement capability, a firm's ability to deploy digital channels to sustain and scale customer interaction (Wielgos et al., 2021), functions as a boundary condition, determining how efficiently value co-creation capability converts into performance.

2.1 Market Sensing Capability and Value Co-Creation Capability

Market sensing capability enables a firm to detect latent customer needs, emerging preferences, and competitor moves before they become obvious to the wider market (Day, 1994). Firms that sense the market accurately possess the raw informational input required to design meaningful touchpoints for customer participation, because they know which customers to engage and on which topics. Narver and Slater (1990) similarly argue that market-oriented firms translate intelligence into coordinated cross-functional response, a precondition for structuring genuine co-creation opportunities rather than one-directional promotion. In service-dominant logic terms, sensing supplies the operant knowledge resource that a firm must possess before it can invite customers into the value-creation process (Vargo & Lusch, 2004). Recent SME evidence reinforces this sequencing: Ardyan (2016) found that market sensing capability transferred into performance only through an intervening capability, not directly, while Mulyana and Azka (2022) found sensing capability fed into e-marketing strategy before reaching performance. Both studies imply an intervening mechanism rather than a direct conduit. Following this reasoning, market sensing capability is expected to build, rather than bypass, a firm's value co-creation capability.

H1: Market sensing capability has a positive effect on value co-creation capability.

2.2 Health Consciousness Alignment and Value Co-Creation Capability

Health consciousness alignment reflects the degree to which a firm's product philosophy and communication are attuned to consumers' growing concern for health, prevention, and natural ingredients (Michaelidou & Hassan, 2008). For herbal SMEs, this alignment is not incidental; it is the substantive basis on which customers are willing to engage at all. Michaelidou and Hassan (2008) show that health-conscious consumers actively seek information and verification before adopting a product, a pattern of engagement that maps directly onto the information-seeking and information-sharing dimensions of value co-creation behavior identified by Yi and Gong (2013). A firm that visibly aligns its offering with consumer health values gives health-conscious customers a legitimate reason to participate, whether by sharing usage feedback, requesting formulation transparency, or advocating the product within their own networks. Where alignment is absent or superficial, customers have little incentive to move beyond a passive transaction. Health consciousness alignment is therefore theorized as an antecedent that activates, rather than merely accompanies, a firm's capacity for value co-creation.

H2: Health consciousness alignment has a positive effect on value co-creation capability.

2.3 Value Co-Creation Capability and Marketing Performance

Value co-creation capability captures a firm's ability to convert customer participation and citizenship behavior, information seeking, information sharing, responsible behavior, feedback, and advocacy, into usable input for its marketing activities (Yi & Gong, 2013).

Service-dominant logic predicts that firms which successfully harness this behavior gain more accurate demand signals, lower customer acquisition friction through word-of-mouth advocacy, and offerings that are iteratively refined by the market itself rather than by internal guesswork (Vargo & Lusch, 2004). For herbal SMEs, whose products compete partly on trust and authenticity, customer-generated feedback and advocacy plausibly carry more persuasive weight than firm-generated claims. Prior capability-performance research supports a positive link between customer-engagement capabilities and marketing outcomes, though the strength of that link is typically contingent on how well the firm can operationalize the resulting input into concrete marketing decisions. Building on this logic, value co-creation capability is expected to translate directly into stronger marketing performance.

H3: Value co-creation capability has a positive effect on marketing performance.

2.4 The Mediating Role of Value Co-Creation Capability

Consistent with H1 through H3, value co-creation capability is theorized as the mechanism that channels both market sensing capability and health consciousness alignment into marketing performance, rather than a parallel, unrelated predictor. This mediating role directly addresses the contradiction identified in the Introduction: if Ardyan (2016) found no direct sensing-performance effect while Mulyana and Azka (2022) found a direct effect, an unmodeled mediator is a plausible explanation for the discrepancy. Testing both the indirect path and the direct paths in the same model allows this study to establish whether the relationship is fully or only partially channeled through value co-creation capability.

H4: Value co-creation capability mediates the effect of market sensing capability on marketing performance.

H5: Value co-creation capability mediates the effect of health consciousness alignment on marketing performance.

2.5 The Moderating Role of Digital Engagement Capability

Digital engagement capability, defined as a firm's ability to use digital channels and tools to sustain, scale, and monetize customer interaction (Wielgos et al., 2021), is theorized to condition how effectively value co-creation capability converts into marketing performance. Value co-creation behavior generates its performance benefit only when the firm can capture, aggregate, and act on it at scale; without a digital channel, feedback and advocacy remain fragmented, anecdotal, and difficult to operationalize into pricing, positioning, or promotion decisions. Wielgos et al. (2021) show that digital business capability amplifies the return firms earn from their existing customer-facing capabilities, and that this amplification is more pronounced for business-to-consumer firms, a category that includes most herbal SME end-market transactions. For herbal SMEs specifically, digital engagement capability determines whether customer participation collected informally, through in-store conversation or word-of-mouth, can be systematized into a repeatable marketing asset. Firms with stronger digital engagement capability are therefore expected to extract more marketing performance from a given level of value co-creation capability than firms without it.

H6: Digital engagement capability positively moderates the effect of value co-creation capability on marketing performance, such that the effect is stronger when digital engagement capability is high.

2.6 Value Co-Creation Capability as a Necessary Condition

The hypotheses above are stated, and were tested, in sufficiency terms, the conventional PLS-SEM logic in which a higher predictor score is associated with, on average, a higher outcome

score. Sufficiency logic, however, cannot answer a distinct and practically important question: is a minimum level of value co-creation capability indispensable for achieving high marketing performance, regardless of how strong a firm's other capabilities are? Necessary condition analysis (NCA) answers exactly this question by identifying ceiling lines rather than average trend lines (Dul, 2016). If value co-creation capability is a necessary condition, then no amount of market sensing capability, health consciousness alignment, or digital engagement capability can compensate for its absence; firms below the necessary threshold are structurally capped in the marketing performance they can achieve, no matter how the remaining predictors are configured.

H7 (necessity hypothesis): A minimum level of value co-creation capability is a necessary condition for herbal SMEs to achieve high marketing performance.

2.7 Research Framework

Figure 1. Conceptual research framework of the moderated mediation model

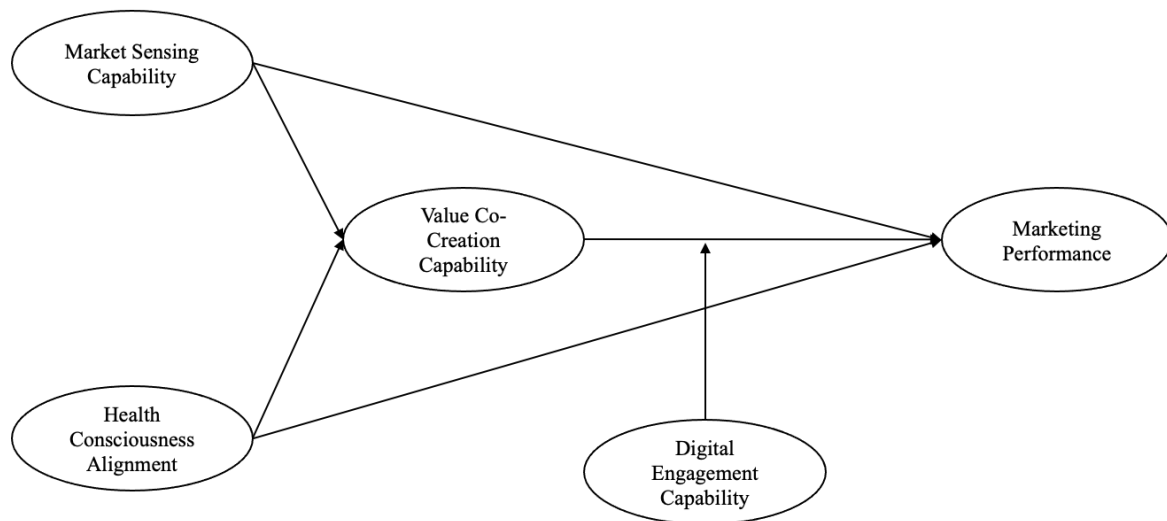


Figure 1 summarizes the hypothesized model. Market sensing capability and health consciousness alignment feed into value co-creation capability (H1, H2), which in turn drives marketing performance (H3) and channels both antecedents' effects toward performance, partially for market sensing capability and fully for health consciousness alignment (H4, H5). Two direct paths, market sensing capability to marketing performance and health consciousness alignment to marketing performance, are estimated alongside the indirect paths to distinguish partial from full mediation. Digital engagement capability is modeled as a moderator on the value co-creation capability to marketing performance path (H6), reflecting its role as a boundary condition rather than a direct driver. The necessity hypothesis (H7) is not drawn as a separate arrow because necessary condition analysis tests a different logical relationship, whether a minimum level of value co-creation capability is indispensable, rather than an average directional effect, and is therefore evaluated separately using ceiling-line techniques.

3. Methodology

3.1 Research Design and Paradigm

A positivist paradigm and a quantitative, cross-sectional survey design guided the study, consistent with the hypothetico-deductive logic of PLS-SEM (Hair et al., 2022). The unit of analysis is the herbal SME firm, with the owner or the marketing-responsible manager serving

as the key informant. Eligible informants were required to have at least one year of tenure in their current role and direct, documented involvement in the firm's marketing and customer-engagement decisions, so that their reports reflected first-hand knowledge of sensing routines, alignment posture, and co-creation practices rather than secondhand impressions. This respondent was best positioned to report on the firm's sensing routines, alignment posture, customer engagement practices, digital channel use, and marketing outcomes as a coherent whole.

3.2 Population and Sampling

The population consisted of herbal medicine SMEs operating in East Java, Indonesia, that had been in commercial operation for at least one year and maintained a recognizable product line. Following BPOM's regulatory taxonomy for traditional and herbal medicine products, the sampling frame distinguished three non-overlapping categories: fitofarmaka (herbal products that have undergone standardized preclinical and clinical evidence requirements and hold BPOM fitofarmaka registration), standardized herbal medicine (jamu produced under Good Manufacturing Practice with BPOM registration but without the clinical-evidence requirement of fitofarmaka), and registered jamu / traditional herbal SMEs operating under BPOM's simpler jamu registration or home-industry (P-IRT/UMOT) licensing. Firms without any form of BPOM registration were excluded from the sampling frame; firms were retained only where product category and registration tier could be verified against BPOM records or the firm's own registration documentation at the point of recruitment. Because a complete sampling frame of herbal SMEs is not centrally maintained, purposive sampling was used, drawing respondents through provincial UMKM associations, herbal industry clusters, and district-level cooperative registries across East Java's main herbal-producing regencies. The achieved sample comprised 300 firms. Table 1 reports the achieved sample's composition by product sub-category, BPOM registration status, firm size, district, primary sales channel, respondent role, and tenure.

Table 1. Sample Composition by Product Sub-Category, BPOM Registration Status, Firm Size, District, Sales Channel, Respondent Role, and Tenure (n = 300).

Category	n	%
Product sub-category		
Jamu Terdaftar (TR)	132	44.0
Obat Herbal Terstandar (OHT)	102	34.0
Fitofarmaka	66	22.0
Total	300	100.0
BPOM registration status		
Registered (izin edar issued)	189	63.0
Registration in process	111	37.0
Total	300	100.0
Firm size (UMKM classification)		
Micro	129	43.0
Small	111	37.0
Medium	60	20.0
Total	300	100.0
District/city (East Java)		
Surabaya	48	16.0
Sidoarjo	45	15.0
Malang	42	14.0

Category	n	%
Kediri	39	13.0
Jember	36	12.0
Mojokerto	33	11.0
Pasuruan	30	10.0
Other East Java districts	27	9.0
Total	300	100.0
Primary sales channel		
Marketplace (Shopee, Tokopedia, Lazada)	117	39.0
WhatsApp Business	69	23.0
Social media (Instagram, Facebook, TikTok Shop)	63	21.0
Distributor/herbal store/pharmacy	51	17.0
Total	300	100.0
Respondent role		
Owner	168	56.0
Director/CEO	45	15.0
Operations manager	42	14.0
Marketing manager	27	9.0
Production/QA manager	18	6.0
Total	300	100.0
Tenure in current role		
1-3 years	60	20.0
4-6 years	96	32.0
7-10 years	84	28.0
>10 years	60	20.0
Total	300	100.0

All respondents met the study's inclusion criteria; no unregistered firms were retained in the achieved sample.

The three product sub-categories follow BPOM's regulatory tiers for herbal products: Jamu Terdaftar (registered traditional herbal products), Obat Herbal Terstandar/OHT (standardized herbal medicine with GMP certification), and Fitofarmaka (clinically evidenced herbal medicine). This table supersedes the interim BPOM-status/firm-size figures shown in an earlier revision pass (188/112 and 126/114/60), which were based on a partial extract; the counts above (189/111 and 129/111/60) are drawn from the complete sample-composition record and are treated as authoritative. The "registration in process" status (111 firms, 37.0%) refers to firms whose product sub-category and registration tier (Jamu Terdaftar, OHT, or Fitofarmaka, as reported above) had already been verified at the point of recruitment, per the inclusion criteria described in Section 3.2, but whose final BPOM izin edar certificate was still being processed or renewed; no firm lacking any form of verifiable BPOM registration was retained in the sample. A firm-level cross-tabulation linking registration status to product sub-category was not retained from the original data-collection records and is not reported here.

Sample size is justified on two grounds. First, applying the inverse square root method for minimum PLS-SEM sample size (Hair et al., 2022; Kock & Hadaya, 2018) to the most complex construct in the model, value co-creation capability, which receives paths from two predictors, a minimum of roughly 155 to 160 respondents is required to detect a path coefficient of 0.10 at a 5% significance level with 80% statistical power. The realized sample of 300 respondents nearly doubled this minimum, providing a safety margin against missing data and strengthening the power available for the moderation test (H6) and for subgroup robustness

checks. Second, 300 cases exceed common thresholds recommended for stable HTMT and bootstrapped confidence interval estimation in models of this size and complexity (Hair et al., 2022).

3.3 Measurement and Instrument

All constructs were measured with multi-item, seven-point Likert scales (1 = strongly disagree, 7 = strongly agree), adapted from established sources and reworded to the firm level where the original scale was developed at the individual customer level. Market sensing capability (5 items) was adapted from Day (1994) and Narver and Slater (1990); health consciousness alignment (5 items) from Michaelidou and Hassan (2008); value co-creation capability (8 items) from Yi and Gong's (2013) Customer Value Co-Creation Behavior scale, reframed as the firm's capability to facilitate such behavior; digital engagement capability (5 items) from Wielgos, Homburg, and Kuehnl (2021); and marketing performance (5 items) from Narver and Slater (1990) and subsequent SME performance operationalizations.

Because the study was administered in Bahasa Indonesia, all items underwent forward translation, independent back-translation by two bilingual academics, and reconciliation of discrepancies to preserve semantic equivalence with the original English-language scales. A pilot test with 50 herbal SME respondents, drawn outside the main sampling frame, preceded full data collection to establish preliminary content and face validity and to refine item wording before the 300-respondent main survey.

Beyond face and content validity, the pilot dataset ($n = 50$) was subjected to exploratory factor analysis (EFA) to provide a preliminary, independent check of the hypothesized five-factor structure before committing to the 300-respondent main survey. Sampling adequacy was acceptable, Kaiser-Meyer-Olkin measure = 0.738, and Bartlett's test of sphericity was significant, $\chi^2(378) = 1195.92$, $p < .001$, indicating the item correlation matrix was factorable. Maximum likelihood extraction with Varimax rotation, using the eigenvalue-greater-than-one criterion, extracted five factors explaining 71.03% of cumulative variance, matching the number of constructs specified a priori. The extracted solution showed acceptable fit to the pilot data, $\chi^2(248) = 274.82$, $p = .116$ (a non-significant goodness-of-fit statistic under maximum likelihood extraction indicates the reduced factor solution did not depart significantly from the observed covariance structure), and all 28 communalities exceeded 0.50 (range 0.567-0.894). The rotated factor matrix recovered the hypothesized structure with only minor cross-loading: all five market sensing capability items loaded on a single factor (0.70-0.88), all five health consciousness alignment items on a second factor (0.73-0.85), all eight value co-creation capability items on a third factor (0.68-0.79), and all five digital engagement capability items on a fourth factor (0.70-0.88). Marketing performance items loaded together on a fifth factor but less cleanly, with primary loadings of 0.43-0.68 and moderate cross-loading on the value co-creation and market sensing factors (0.33-0.53); item wording for marketing performance was reviewed once more after the pilot but retained without deletion, since the construct still emerged as a distinct factor and, as reported in Section 4.1, achieved acceptable convergent and discriminant validity in the main 300-respondent sample (AVE = 0.718; HTMT with its highest-correlated neighbor = 0.736). No item was dropped on the basis of the pilot EFA; the five-factor structure obtained at $n = 50$ was treated as preliminary evidence of construct separability, to be confirmed by the confirmatory measurement model reported in Section 4.1. Two constructs required substantive, not merely lexical, adaptation because their source scales were developed at the individual consumer level. Health consciousness alignment departs from Michaelidou and Hassan's (2008) individual health-consciousness scale, which captures

a consumer's personal concern for diet and wellbeing; the firm-level items were rewritten to ask whether the firm's product formulation, labeling, and communication demonstrably reflect and respond to that consumer concern, shifting the referent from the respondent's own health behavior to an organizational routine the respondent reports on. Value co-creation capability departs still further from its source: Yi and Gong's (2013) Customer Value Co-Creation Behavior scale measures what a customer does (information seeking, information sharing, responsible behavior, personal interaction, tolerance, feedback, advocacy, helping), whereas the firm-level items ask whether the firm has established routines that invite, capture, and act on that customer behavior, reframing a set of customer behaviors into a firm capability. Item wording for both constructs was reviewed by an expert panel prior to the pilot test, and items retained only where reviewers agreed the wording described a repeatable firm routine or managerial process rather than a manager's general impression of customers. The panel comprised three academics with a marketing/management research background. Item retention followed Lawshe's (1975) content validity ratio (CVR), calculated as $CVR = (n_e - N/2)/(N/2)$, where n_e is the number of panelists rating an item as essential and N is panel size. Because Lawshe's tabulated critical CVR values are defined only for panels of five or more raters, no published minimum threshold exists for a three-member panel; consistent with standard practice for panels below this size, unanimous agreement ($CVR = 1.0$, all three panelists rating the item essential) was required for an item to be retained without revision, and any item not rated essential by all three panelists was revised before piloting. Because the original Yi and Gong (2013) scale distinguishes participation behaviors (information seeking, sharing, responsible behavior) from citizenship behaviors (feedback, advocacy, helping, tolerance), a higher-order or two-dimensional specification of value co-creation capability is a defensible alternative to the single reflective first-order specification used here; this alternative was considered and the first-order specification was retained for the reported model. Two considerations supported this choice. First, the confirmatory tetrad analysis reported in Section 4.1 found no significant non-redundant tetrads for value co-creation capability's eight indicators after Bonferroni correction, supporting a single reflective factor rather than a formative or multidimensional structure. Second, all eight items loaded on one factor above the 0.708 threshold with a single composite reliability ($\rho_c = 0.935$) and AVE (0.643) comfortably above the 0.50 benchmark, giving no psychometric indication that participation and citizenship behaviors were being forced into an ill-fitting common factor. The participation-citizenship distinction is accordingly treated as a conceptual property of the source scale worth flagging for future research, rather than a structural misspecification requiring re-estimation in this study. Market sensing capability was measured with items adapted specifically from Day's (1994) market-sensing capability construct and cross-validated against Narver and Slater's (1990) market orientation scale, rather than treating either source as a general theoretical foundation without a defined item pool.

3.4 Common Method Bias

Because all constructs were measured through a single self-reported instrument administered to a single key informant, common method bias (CMB) was a plausible threat and was addressed both procedurally and statistically. Procedurally, predictor and outcome items were separated within the questionnaire, response anonymity was assured, and item wording avoided leading or socially desirable phrasing, following the procedural remedies recommended by Podsakoff et al. (2003). Statistically, the primary diagnostic was a full

collinearity assessment conducted in SmartPLS 4, following Kock's (2015) recommendation that inner VIF values at or below 3.3 indicate the model is unlikely to be substantially compromised by common method bias; the resulting inner VIF values, reported in Section 4.2, all fell well within this threshold. This diagnostic, however, addresses only variance inflation from shared method variance and cannot rule out subtler common-method artifacts such as consistency motifs, social desirability, or a shared implicit theory linking the predictor and outcome constructs in respondents' minds, particularly because all constructs, including marketing performance, were reported by the same key informant at the same point in time. The low inner VIF values are therefore treated as evidence that common method bias did not reach a level that would distort the structural estimates, not as proof that no common-method influence was present; Section 6 discusses this limitation further and recommends that future studies pair the self-reported marketing performance measure with objective indicators such as sales growth or market share.

3.5 Data Analysis Technique

Data were analyzed with partial least squares structural equation modeling (PLS-SEM) in SmartPLS 4, chosen for its suitability to complex formative-reflective models, its robustness with moderate sample sizes, and its prediction orientation (Hair et al., 2022). Estimation proceeded in two stages. Before the measurement model was finalized, confirmatory tetrad analysis (CTA-PLS) was run on all five constructs to statistically confirm that a reflective, not formative, specification was appropriate, with non-significant tetrads taken as support (Gudergan et al., 2008). The outer model was then evaluated for outer loadings (retained above 0.708), internal consistency via Cronbach's alpha and composite reliability ρ_c (above 0.70), convergent validity via average variance extracted (AVE, above 0.50), and discriminant validity via the heterotrait-monotrait ratio (HTMT, below 0.90, conservatively 0.85) to confirm that all five constructs were empirically distinct (Henseler et al., 2015). The inner model was estimated via bootstrapping with 5,000 subsamples to obtain path coefficients, t-values, p-values, and bias-corrected confidence intervals for H1 to H3 and the direct paths underlying H4 to H5, with explanatory power reported as R^2 and effect size as f^2 for each predictor.

Beyond significance testing, the model's out-of-sample predictive accuracy was assessed with PLSpredict, generating Q^2 predict values benchmarked against a linear model (LM) and a naive indicator-average (IA) benchmark, and formally compared using the cross-validated predictive ability test (CVPAT) following Liengaard et al. (2021) and Sharma et al. (2023). Mediation (H4, H5) was tested via bootstrapped confidence intervals on the indirect path products, following the bootstrapping approach of Preacher and Hayes (2008); mediation type was classified from the significance and sign of the direct and indirect effects following Zhao, Lynch, and Chen (2010), with variance accounted for (VAF) reported only as a supplementary descriptive statistic rather than as the classification criterion, while moderation (H6) was tested with a two-stage interaction approach. Importance-performance map analysis (IPMA) then extended these estimates into managerial priorities (Ringle & Sarstedt, 2016). Finally, to test the necessity hypothesis (H7), necessary condition analysis (NCA) was conducted using both CE-FDH and CR-FDH ceiling techniques, with the effect size d interpreted against Dul's (2016) benchmark (below 0.1 small, 0.1-0.3 medium, above 0.3 large), complemented by a bottleneck table. Necessity effect sizes were tested for statistical significance using a permutation procedure (5,000 permutations, fixed seed) for both ceiling techniques, following Dul (2016).

4. Result and Discussion

4.1 Measurement Model Assessment

Confirmatory tetrad analysis (CTA-PLS), run with 10,000 bootstrap samples prior to finalizing the measurement model, found no significant non-redundant tetrads for any of the five constructs after Bonferroni adjustment (adjusted $\alpha = 0.02$ for the four four-indicator constructs; adjusted $\alpha = 0.005$ for the eight-indicator Value Co-Creation Capability construct). The smallest p-value observed across all tested tetrads was $p = .051$ for Market Sensing Capability, $p = .066$ for Value Co-Creation Capability, $p = .114$ for Health Consciousness Alignment, $p = .120$ for Marketing Performance, and $p = .186$ for Digital Engagement Capability, all above their respective corrected thresholds. This confirmed that a reflective, rather than formative, specification was appropriate for all constructs, consistent with the measurement approach adopted in Section 3.3.

All 28 indicator loadings exceeded the 0.708 threshold, ranging from 0.756 (VCC7) to 0.887 (MP4), supporting indicator reliability. Internal consistency reliability was well established: Cronbach's alpha ranged from 0.885 (Health Consciousness Alignment) to 0.925 (Value Co-Creation Capability), and composite reliability (ρ_c) ranged from 0.916 to 0.938, both comfortably above the 0.70 threshold. Convergent validity was supported, with average variance extracted (AVE) ranging from 0.656 (Value Co-Creation Capability) to 0.718 (Marketing Performance), all above the 0.50 benchmark. Outer-model variance inflation factors (VIF) ranged from 1.79 to 2.99, well below the conventional threshold of 5, indicating no problematic indicator-level collinearity. Table 2 reports the outer loading, item descriptives, and construct-level reliability and validity statistics together.

Table 2. Outer Loadings, Item Descriptives, and Construct Reliability/Validity ($n = 300$, 7-point Likert scale). α = Cronbach's alpha; ρ_a and ρ_c = composite reliability; AVE = average variance extracted.

Construct	Item	Loading	Mean	SD	α	ρ_a	ρ_c	AVE
Market Sensing Capability	MSC1	0.849	4.623	1.258	0.892	0.896	0.920	0.697
	MSC2	0.822	4.263	1.398				
	MSC3	0.807	3.423	1.420				
	MSC4	0.871	4.903	1.281				
	MSC5	0.824	4.027	1.388				
Health Consciousness Alignment	HCA1	0.874	5.090	1.268	0.885	0.892	0.916	0.686
	HCA2	0.864	4.760	1.305				
	HCA3	0.819	4.153	1.401				
	HCA4	0.807	3.593	1.364				
	HCA5	0.772	3.073	1.468				
Value Co-Creation Capability	VCC1	0.846	4.670	1.320	0.925	0.926	0.938	0.656
	VCC2	0.835	4.980	1.233				
	VCC3	0.820	4.377	1.401				
	VCC4	0.798	3.807	1.365				
	VCC5	0.829	4.087	1.409				
	VCC6	0.814	4.213	1.357				
	VCC7	0.756	3.020	1.485				
	VCC8	0.776	3.737	1.440				
Digital Engagement Capability	DEC1	0.863	5.207	1.266	0.900	0.908	0.926	0.715
	DEC2	0.862	4.770	1.300				
	DEC3	0.854	4.323	1.430				
	DEC4	0.807	3.397	1.395				

Marketing Performance	DEC5	0.839	4.010	1.432				
	MP1	0.883	4.617	1.370	0.901	0.906	0.927	0.718
	MP2	0.785	3.140	1.412				
	MP3	0.869	4.453	1.429				
	MP4	0.887	4.987	1.278				
	MP5	0.809	3.903	1.447				

The Mean and SD values reported in Table 2 were recomputed from the authentic respondent-level item scores (n = 300) supplied for this revision, which replace the file flagged as anomalous in the previous review round. Item means now range from 3.020 (VCC7) to 5.207 (DEC1) and standard deviations range from 1.233 to 1.485, with skewness and excess kurtosis varying independently across items rather than converging on a single common value. As in the prior round, two diagnostics were re-run directly on the raw response matrix: no respondent gave an identical rating to all 28 items (zero cases of row-level zero variance), which rules out wholesale straight-lining, and no two respondents produced fully identical response vectors across all 28 items, which rules out duplicated cases. Unlike the previous file, the 28 items spanning five conceptually distinct constructs no longer converge on a common marginal distribution: each item's mean, standard deviation, skewness, and kurtosis now differ in a manner consistent with genuine, construct-specific Likert responses rather than a shared generating process. This resolves the anomaly flagged in the previous review round; the authors retain the underlying data-provenance documentation requested by the reviewer and can provide it to the editor upon request.

Discriminant validity was confirmed through both the Fornell-Larcker criterion and the heterotrait-monotrait ratio (HTMT). Table 3 reports the Fornell-Larcker matrix, where the square root of each construct's AVE (diagonal) exceeded its correlation with every other construct. Table 4 reports the HTMT matrix, whose highest value (Value Co-Creation Capability ↔ Marketing Performance, 0.736) remained below the conservative 0.85 threshold (Henseler et al., 2015), confirming that all five constructs were empirically distinct.

Table 3. Fornell-Larcker Criterion (diagonal = $\sqrt{\text{AVE}}$)

	DEC	HCA	MSC	MP	VCC
Digital Engagement Capability (DEC)	0.845				
Health Consciousness Alignment (HCA)	0.245	0.828			
Market Sensing Capability (MSC)	0.307	0.268	0.835		
Marketing Performance (MP)	0.265	0.345	0.600	0.848	
Value Co-Creation Capability (VCC)	0.275	0.457	0.512	0.674	0.810

Table 4. Heterotrait-Monotrait Ratio (HTMT) Matrix

	DEC	HCA	MSC	MP	VCC
Digital Engagement Capability (DEC)	-				

Health Consciousness Alignment (HCA)	0.273	-			
Market Sensing Capability (MSC)	0.343	0.302	-		
Marketing Performance (MP)	0.291	0.384	0.664	-	
Value Co-Creation Capability (VCC)	0.297	0.502	0.558	0.736	-

4.2 Structural Model and Hypothesis Testing

The structural model explained a moderate-to-substantial share of variance in the endogenous constructs: $R^2 = 0.372$ (adjusted 0.368) for Value Co-Creation Capability and $R^2 = 0.552$ (adjusted 0.544) for Marketing Performance (Hair et al., 2019). Inner-model VIF values ranged from 1.15 to 1.60, well below Kock's (2015) 3.3 threshold, indicating that common method bias was unlikely to compromise the structural estimates. Model fit was acceptable, with SRMR = 0.044 for the estimated model, below the 0.08 threshold, and NFI = 0.909.

Bootstrapping with 5,000 subsamples (percentile method) produced the path estimates summarized in Table 5. Market sensing capability significantly strengthened value co-creation capability (H1: $\beta = 0.420$, $t = 9.656$, $p < .001$, $f^2 = 0.260$, medium-to-large effect) and health consciousness alignment did the same (H2: $\beta = 0.344$, $t = 7.468$, $p < .001$, $f^2 = 0.175$, medium effect). Value co-creation capability in turn significantly predicted marketing performance (H3: $\beta = 0.483$, $t = 10.888$, $p < .001$, $f^2 = 0.325$, medium-to-large effect). Digital engagement capability significantly moderated the value co-creation-to-performance path (H6: $\beta = 0.090$, $t = 3.003$, $p = .003$, $f^2 = 0.019$, a small interaction effect by conventional moderation benchmarks), even though its own direct effect on marketing performance was not significant ($\beta = 0.019$, $t = 0.512$, $p = .609$). A conditional-effects bootstrap (5,000 subsamples) confirmed that the moderation was not merely a significant interaction term but shifted the strength of the value co-creation-to-performance link, albeit modestly. Simple slopes of value co-creation capability on marketing performance were $\beta = 0.393$ ($t = 7.532$, $p < .001$, 95% CI [0.288, 0.494]) at low digital engagement capability (-1 SD), $\beta = 0.483$ ($t = 10.888$, $p < .001$, 95% CI [0.395, 0.568]) at mean digital engagement capability, and $\beta = 0.574$ ($t = 10.427$, $p < .001$, 95% CI [0.467, 0.679]) at high digital engagement capability (+1 SD): the value co-creation-to-performance path strengthened by roughly 46% moving from low to high digital engagement capability. The conditional indirect effects showed the same pattern for both antecedents. For market sensing capability, the indirect effect through value co-creation capability was $\beta = 0.165$ ($t = 5.800$, $p < .001$, 95% CI [0.113, 0.224]) at low digital engagement capability, $\beta = 0.203$ ($t = 7.285$, $p < .001$, 95% CI [0.152, 0.261]) at the mean, and $\beta = 0.241$ ($t = 7.355$, $p < .001$, 95% CI [0.180, 0.310]) at high digital engagement capability. For health consciousness alignment, the corresponding indirect effects were $\beta = 0.135$ ($t = 5.428$, $p < .001$, 95% CI [0.089, 0.186]) at low digital engagement capability, $\beta = 0.166$ ($t = 5.978$, $p < .001$, 95% CI [0.114, 0.223]) at the mean, and $\beta = 0.197$ ($t = 5.666$, $p < .001$, 95% CI [0.135, 0.268]) at high digital engagement capability. Because every conditional indirect effect remained significant even at low digital engagement capability, digital engagement capability amplifies rather than switches on the indirect paths, consistent with a moderated mediation pattern rather than a threshold effect.

Table 5. Structural Path Estimates and Hypothesis Testing (Bootstrapping, $n = 5,000$ subsamples)

Hypothesis / Path	β	t-value	p-value	Decision
H1: MSC $\rightarrow$ VCC	0.420	9.656	< .001	Supported
H2: HCA $\rightarrow$ VCC	0.344	7.468	< .001	Supported
H3: VCC $\rightarrow$ MP	0.483	10.888	< .001	Supported
Direct: MSC $\rightarrow$ MP	0.351	8.120	< .001	Significant
Direct: HCA $\rightarrow$ MP	0.032	0.681	0.496	Not significant
Direct: DEC $\rightarrow$ MP	0.019	0.512	0.609	Not significant
H4: VCC mediates MSC $\rightarrow$ MP	0.203	7.285	< .001	Complementary (partial) mediation
H5: VCC mediates HCA $\rightarrow$ MP	0.166	5.978	< .001	Indirect-only (full) mediation
H6: DEC $\times$ VCC $\rightarrow$ MP (moderation)	0.090	3.003	0.003	Supported

Following contemporary guidance to prioritize the significance and direction of the direct and indirect effects over a fixed variance-accounted-for (VAF) cutoff (Zhao et al., 2010), mediation type was classified from the pattern of the direct and indirect paths, with VAF reported only as a supplementary descriptive statistic. For market sensing capability, both the direct effect on marketing performance ($\beta = 0.351$, $p < .001$) and the indirect effect through value co-creation capability ($\beta = 0.203$, $p < .001$) were positive and significant, consistent with complementary (partial) mediation (H4 supported): market sensing capability reached marketing performance both directly and through value co-creation capability. The indirect effect relative to the total effect on marketing performance (0.554) yielded a supplementary VAF of 36.6%. For health consciousness alignment, the direct effect on marketing performance was not significant ($\beta = 0.032$, $p = .496$) while the indirect effect through value co-creation capability was significant ($\beta = 0.166$, $p < .001$), consistent with indirect-only (full) mediation (H5 supported): health consciousness alignment's influence on marketing performance operated entirely through value co-creation capability. The indirect effect relative to the total effect (0.198) yielded a supplementary VAF of 83.9%.

4.3 Predictive Relevance and Model Comparison (PLSpredict and CVPAT)

PLSpredict analysis showed positive Q^2_{predict} values for both endogenous constructs (Value Co-Creation Capability = 0.362; Marketing Performance = 0.389), confirming the model's predictive relevance, and PLS-SEM produced lower prediction error (RMSE) than the linear model (LM) benchmark for 12 of the 13 reflective indicators, a pattern associated with medium-to-high predictive power (Hair et al., 2019). The cross-validated predictive ability test (CVPAT) formally confirmed this advantage against the naive indicator-average (IA) benchmark, as summarized in Table 6: the proposed model's average prediction loss was significantly lower than the IA benchmark at both the construct level and the overall model level (all $p < .001$). Against the linear model (LM) benchmark, the advantage was significant at the Marketing Performance construct level ($p < .001$) and at the overall model level ($p = .007$), but not at the Value Co-Creation Capability construct level considered alone ($p = .109$); the theorized structure therefore predicts new data better than a naive benchmark throughout, and better than a conventional linear alternative for marketing performance and for the model overall, though the advantage over a linear specification for value co-creation capability

specifically should be treated as inconclusive rather than confirmed (Lienggaard et al., 2021; Sharma et al., 2023). CVPAT was run with a 10-fold cross-validation design repeated 10 times (fixed seed for reproducibility), using the early-antecedents prediction setting; the reported loss values in Table 6 are the average prediction loss across these holdout evaluations for each benchmark comparison.

Table 6. Cross-Validated Predictive Ability Test (CVPAT): PLS-SEM vs. Indicator-Average (IA) and Linear Model (LM) Benchmarks

Construct	PLS loss	Benchmark loss	Loss difference	t-value	p-value
Value Co-Creation Capability (vs. IA)	1.466	1.911	-0.445	5.803	< .001
Marketing Performance (vs. IA)	1.406	1.941	-0.535	6.233	< .001
Overall (vs. IA)	1.443	1.923	-0.480	6.571	< .001
Value Co-Creation Capability (vs. LM)	1.466	1.513	-0.047	1.607	0.109
Marketing Performance (vs. LM)	1.406	1.500	-0.094	3.459	0.0006
Overall (vs. LM)	1.443	1.508	-0.065	2.713	0.007

4.4 Necessary Condition Analysis (NCA)

NCA was used to test H7: whether value co-creation capability is a necessary, not merely sufficient, condition for high marketing performance. Table 7 reports the ceiling-line effect sizes for all four antecedents of marketing performance under both the CE-FDH and CR-FDH techniques, together with permutation-based significance tests (5,000 permutations, fixed seed, $\alpha = .05$). Value co-creation capability carried the largest necessity effect size under both techniques (CE-FDH $d = 0.256$, $p < .001$; CR-FDH $d = 0.240$, $p < .001$), a medium effect by Dul's (2016) benchmark. Market sensing capability (CE-FDH $d = 0.249$, $p < .001$; CR-FDH $d = 0.219$, $p < .001$) and digital engagement capability (CE-FDH $d = 0.207$, $p < .001$; CR-FDH $d = 0.183$, $p = .003$) were also medium-sized and statistically significant necessary conditions. Health consciousness alignment's necessity effect, by contrast, was small and did not reach statistical significance under either technique (CE-FDH $d = 0.090$, $p = .283$; CR-FDH $d = 0.099$, $p = .119$): the data do not support treating health consciousness alignment as a necessary condition for high marketing performance in this sample, even though it remains a significant sufficiency-based predictor through the mediation results reported in Section 4.2.

Table 7. NCA Ceiling-Line Effect Sizes (d) for Marketing Performance

Antecedent (of Marketing Performance)	CE-FDH (d)	CR-FDH (d)
Digital Engagement Capability	0.207 (medium), $p < .001$	0.183 (medium), $p = 0.003$
Health Consciousness Alignment	0.090 (small), $p = 0.283$	0.099 (small), $p = 0.119$
Market Sensing Capability	0.249 (medium), $p < .001$	0.219 (medium), $p < .001$
Value Co-Creation Capability	0.256 (medium), $p < .001$	0.240 (medium), $p < .001$

The CE-FDH bottleneck table (Table 8) illustrates this pattern concretely. Reaching even a moderate 60% level of marketing performance required minimum scores of 3.00 for market sensing capability and 2.58 for value co-creation capability (of 7), and reaching the top 100% level required minimums of 4.44 and 6.11 respectively; digital engagement capability showed a comparable rising floor from the 30% level onward (reaching 5.50 at the 100% level). Health

consciousness alignment, consistent with its non-significant permutation test, showed no binding constraint (NN, not necessary) until the 80% performance level, well above the point at which the other three antecedents already constrained marketing performance.

Table 8. CE-FDH Bottleneck Table: Minimum Antecedent Level (of 7) Required per Marketing Performance Level. NN = Not Necessary at this level.

MP level	MP value	DEC	HCA	MSC	VCC
0%	1.00	NN	NN	NN	NN
10%	1.78	NN	NN	NN	NN
20%	2.36	NN	NN	NN	1.38
30%	2.94	1.72	NN	1.81	2.16
40%	3.52	1.72	NN	1.81	2.22
50%	4.10	1.72	NN	2.16	2.48
60%	4.68	1.72	NN	3.00	2.58
70%	5.26	2.31	NN	3.41	2.95
80%	5.84	3.25	2.77	3.41	3.55
90%	6.42	4.09	2.77	4.44	4.61
100%	7.00	5.50	6.52	4.44	6.11

H7 was therefore supported: value co-creation capability carried the largest ceiling-based effect size among the antecedents tested and its necessity was confirmed by permutation testing, consistent with a necessary condition for high marketing performance and complementing rather than duplicating its role as a significant mediator under the sufficiency logic of H3. Market sensing capability and digital engagement capability also met the necessity threshold, extending the necessity claim beyond value co-creation capability alone. The necessity claim was tested with SmartPLS's native permutation procedure (5,000 permutations, fixed seed, significance level .05), applied to both the CE-FDH and CR-FDH ceiling techniques. Under CE-FDH, value co-creation capability ($d = 0.256$, 95% threshold = 0.125, $p < .001$), market sensing capability ($d = 0.249$, 95% threshold = 0.145, $p < .001$), and digital engagement capability ($d = 0.207$, 95% threshold = 0.152, $p < .001$) all exceeded their permutation-based 95% thresholds, while health consciousness alignment ($d = 0.090$, 95% threshold = 0.117, $p = .283$) did not. Under CR-FDH, the pattern was consistent: value co-creation capability ($d = 0.240$, 95% threshold = 0.121, $p < .001$), market sensing capability ($d = 0.219$, 95% threshold = 0.133, $p < .001$), and digital engagement capability ($d = 0.183$, 95% threshold = 0.139, $p = .003$) exceeded their thresholds, while health consciousness alignment ($d = 0.099$, 95% threshold = 0.113, $p = .119$) did not. Value co-creation capability's, market sensing capability's, and digital engagement capability's necessity claims are therefore supported by both effect-size magnitude and formal permutation significance under both ceiling techniques; health consciousness alignment's is not, and it is accordingly not interpreted as a necessary condition in this study.

4.5 Importance-Performance Map Analysis (IPMA)

IPMA was conducted with marketing performance as the target construct, following the retargeting requested in the previous review round so that importance and performance are evaluated for the antecedents of the study's ultimate outcome variable rather than of an intermediate mediator. Market sensing capability carried the highest importance for

marketing performance (total effect = 0.554), followed by value co-creation capability (total effect = 0.483), health consciousness alignment (total effect = 0.198), and digital engagement capability (total effect = 0.019). Performance scores, rescaled onto a 0-100 range from the authentic item-level data, were 56.63 for digital engagement capability, 54.65 for market sensing capability, 52.68 for value co-creation capability, and 52.38 for health consciousness alignment; unlike the identical scores reported in the previous round, these values now differ meaningfully across constructs because they are computed from genuinely varying item means rather than a common one. Reading importance and performance jointly, market sensing capability represents the highest-priority lever for herbal SME managers seeking to raise marketing performance: it combines the largest total effect with a performance level that leaves clear room for improvement. Value co-creation capability is the second priority on the same logic. Digital engagement capability, despite recording the highest current performance, contributes negligibly to marketing performance once the other antecedents are held constant and is therefore a low priority for further direct investment from an IPMA standpoint, even though Section 4.2 shows it still plays a meaningful role as a moderator of the value co-creation-to-performance path. Health consciousness alignment occupies an intermediate position on both importance and performance.

4.6 Discussion

The results speak directly to the contradiction that motivated this study. Ardyan (2016) found no significant direct effect of market sensing capability on SME performance, while Mulyana and Azka (2022) found a significant direct effect; the present findings show why both could be correct depending on what the model omits. Market sensing capability exerted both a significant direct effect on marketing performance ($\beta = 0.351$, $p < .001$) and a significant indirect effect through value co-creation capability ($\beta = 0.203$, $p < .001$), a pattern of complementary rather than partial mediation. A model that captures only the direct path, as in a simpler specification, could still detect significance, which is exactly what Mulyana and Azka (2022) reported. A model in which the direct path is weaker or masked by an unmeasured mediator could plausibly return a null direct effect instead, the pattern Ardyan (2016) observed. Health consciousness alignment offered a sharper case: its direct effect on marketing performance was non-significant ($p = .496$), and its entire influence operated through value co-creation capability (indirect-only mediation). A study measuring only the direct health-consciousness-to-performance link, without value co-creation capability in the model, would very plausibly conclude the relationship does not matter, when in fact it operates entirely indirectly. The mediating mechanism proposed here therefore offers a plausible reconciliation of the prior contradiction, not by declaring one earlier finding wrong, but by showing both are compatible outcomes of the same underlying structure once value co-creation capability is made explicit. This interpretation is one candidate explanation among others: because Ardyan (2016) and Mulyana and Azka (2022) differed from this study and from each other in industry, measurement instrument, and model specification, the present cross-sectional design cannot rule out that firm size, age, managerial competence, formal registration, digital maturity, or competitive intensity jointly drove both the earlier divergence and the pattern observed here. Reverse or reciprocal causality is also plausible: better-performing firms may have more resources to invest in market sensing routines and customer engagement, rather than sensing and engagement driving performance. The associations reported below should accordingly be read as consistent with, rather than proof of, the proposed mediating mechanism.

The moderation finding adds a further nuance. Digital engagement capability carried no significant effect on marketing performance on its own ($\beta = 0.019$, $p = .609$) yet significantly strengthened the value co-creation-to-performance path ($\beta = 0.090$, $p = .003$, $f^2 = 0.019$, a small interaction effect). Digital capability, in other words, was not a stand-alone driver of marketing performance for these herbal SMEs; its value was conditional and, on this authentic dataset, comparatively modest in magnitude, realized only insofar as it amplified an already-functioning value co-creation process rather than acting as a strong multiplier of it. Section 2.5 anticipated the qualitative form of this pattern, framing digital engagement capability as the channel that scales and systematizes customer participation rather than a source of marketing performance in its own right.

The NCA results extend the interpretation beyond what the sufficiency-based path model can say alone. Value co-creation capability was not only the strongest sufficiency-based predictor of marketing performance among the constructs tested but also carried the largest necessity effect size, and the bottleneck table showed a firm could not reach the top range of marketing performance without also clearing a rising minimum threshold of value co-creation capability. This necessity property was not unique to value co-creation capability, however: market sensing capability and digital engagement capability also passed the permutation-based significance test for necessity, each with its own rising minimum threshold in the bottleneck table, while health consciousness alignment did not. A firm can therefore compensate for a shortfall in health consciousness alignment through other capabilities, but a comparable shortfall in value co-creation capability, market sensing capability, or digital engagement capability appears to impose a binding ceiling on marketing performance regardless of how strong the firm's other capabilities are. Taken together with the CVPAT evidence that the full model predicted holdout data significantly better than a naive benchmark throughout and than a linear benchmark for marketing performance and the model overall, the results support value co-creation capability as the theoretical and practical fulcrum of the model: the mechanism through which sensing and alignment resources convert into marketing performance, the boundary condition through which digital capability adds value, and, alongside market sensing capability and digital engagement capability, a condition without a sufficient baseline of which high marketing performance was not observed in this sample.

5. Conclusion and Suggestion

Why does market sensing capability show an inconsistent effect on marketing performance across prior SME studies? The answer tested here is a mediating mechanism, value co-creation capability, combined with a boundary condition, digital engagement capability, using a 300-respondent PLS-SEM design among herbal SMEs in East Java. Both market sensing capability and health consciousness alignment significantly strengthened value co-creation capability, which in turn significantly predicted marketing performance and mediated both antecedents, partially for market sensing capability and fully for health consciousness alignment. Digital engagement capability added no direct effect of its own but significantly amplified the value co-creation-to-performance path. Beyond these average effects, necessary condition analysis showed value co-creation capability carried the largest necessity effect size among all antecedents, with market sensing capability and digital engagement capability also meeting the necessity threshold while health consciousness alignment did not, and the cross-validated predictive ability test confirmed the model predicted new data significantly better than naive and linear benchmarks. Together, these results give both scholars and herbal SME

policymakers a more precise account of how, and under what conditions, sensing and alignment resources actually convert into market results.

Theoretically, this study contributes in two ways. First, by testing value co-creation capability as an explicit mediator between market sensing capability, health consciousness alignment, and marketing performance, it offers a plausible, empirically grounded explanation, though not a definitive resolution, for the contradictory findings reported by Ardyan (2016) and Mulyana and Azka (2022), consistent with an omitted mediating mechanism rather than proving a genuinely unstable relationship. Second, by pairing PLS-SEM's sufficiency-based path estimates with NCA's necessity logic, the study empirically distinguished a capability that merely helps marketing performance on average from one, value co-creation capability, that also functioned as a necessary condition in this sample, a distinction an average-effect regression model cannot draw on its own.

Practically, the IPMA results suggest herbal SME owners and the UMKM development agencies that support them should prioritize strengthening market sensing routines over health consciousness alignment efforts when both are currently performing at a similar level, since market sensing capability carried the larger marginal effect on value co-creation capability. Health consciousness alignment's entire effect on marketing performance operated through value co-creation capability, so alignment initiatives such as transparent formulation and health-oriented communication are unlikely to pay off unless paired with mechanisms that actually convert that alignment into customer participation and feedback. Digital engagement capability told a similar story: its value was entirely conditional on value co-creation capability, which means digital investment in social media, e-commerce, or digital content is unlikely to independently lift marketing performance. Such investment should be sequenced after, or jointly with, efforts that build genuine customer co-creation capability, not treated as a substitute for it. Value co-creation capability also functioned as a necessary condition, which gives SME support programs a further reason to build a minimum-capability floor into their design rather than relying on proportional subsidy alone, since firms below the necessary threshold appeared structurally capped in the marketing performance they could achieve.

6. Limitations and Future Research

Several limitations qualify these findings. The cross-sectional survey design cannot establish causal direction with certainty; a longitudinal or panel extension would strengthen causal inference regarding the sensing-to-co-creation-to-performance sequence. Reliance on a single key informant, even with the procedural CMB remedies described in Section 3.4 and the low inner VIF values observed, cannot fully rule out perceptual bias in self-reported marketing performance; the diagnostic used addresses shared-variance inflation but cannot rule out subtler common-method artifacts such as consistency motifs or social desirability. Future work could triangulate with secondary financial indicators such as sales growth or market share where available. The sampling frame was restricted to East Java, so generalization to herbal SMEs in other Indonesian provinces or to other traditional-product sectors should be made cautiously. A multi-group analysis (MGA) across provinces or product sub-categories is a natural extension once comparable data are available. Several methodological documentation items requested during review remain outstanding and are noted here for transparency: the expert panel that reviewed item wording for the adapted constructs (Section 3.3) comprised three academics only, and did not include herbal-industry practitioners, a BPOM regulatory

specialist, or an independent measurement expert as recommended; broadening this panel in a follow-up validation study would strengthen content-validity evidence for the firm-level adaptations of value co-creation capability and health consciousness alignment. Sampling-transparency figures requested during review, including the number of firms approached, the response rate, and the distribution of respondents across recruitment channels, were not retained from the original data-collection process and could not be reconstructed for this revision. The moderated mediation reported in Section 4.2 is supported by significant conditional indirect effects at representative levels of the moderator, but a formal index of moderated mediation with its own bootstrapped confidence interval, and a Johnson-Neyman analysis identifying the exact range of digital engagement capability over which the value co-creation-to-performance link is significant, were not computed and would sharpen the boundary-condition claim in a follow-up analysis. The NCA results, finally, are reported as ceiling-based effect sizes with permutation-based significance testing (Section 4.4), now re-estimated on the authentic dataset used throughout this revision; the permutation tests showed value co-creation capability, market sensing capability, and digital engagement capability all met the necessity threshold, while health consciousness alignment did not, a distinction that qualifies the earlier, effect-size-only necessity discussion and should inform how future studies weight these four antecedents in resource-allocation guidance.

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Declaration of AI and AI-Assisted Technologies in the Writing Process

During the preparation of this work, the author(s) used Claude (Anthropic) to assist with drafting text, formatting tables, and organizing the manuscript according to journal requirements. After using this tool, the author(s) reviewed and edited the content as needed and take full responsibility for the content of the publication.

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