Digital marketing, customer engagement, supply chain agility, and flexible logistics as capability drivers of dynamic marketing channel performance: an operations management perspective

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Abstract: This study addresses the limited integration of marketing and operations perspectives in explaining dynamic marketing channel performance in complex markets. Drawing on capability integration logic, it examines how digital marketing, customer engagement, supply chain agility, and flexible logistics function as capability drivers of dynamic marketing channel performance. Survey data from 500 Thai firms were analysed using structural equation modelling. The results show that digital marketing significantly enhances customer engagement and supply chain agility. Supply chain agility strengthens flexible logistics and directly improves dynamic marketing channel performance, while customer engagement and flexible logistics also exert significant positive effects. The model explains 75.9% of the variance in dynamic marketing channel performance, indicating that firms improve channel outcomes through coordinated digital, relational, supply-side, and logistics capabilities. The study contributes to services and operations management research by conceptualising dynamic marketing channel performance as a capability outcome enabled by operational integration.

Keywords: digital marketing; customer engagement; supply chain agility; flexible logistics; dynamic marketing channel performance; operations management; capability integration; digital capability; channel integration; logistics responsiveness.

Reference to this paper should be made as follows: Sukhawatthanakun, K. (2026) 'Digital marketing, customer engagement, supply chain agility, and flexible logistics as capability drivers of dynamic marketing channel performance: an operations management perspective', *Int. J. Services and Operations Management*, Vol. 54, No. 5, pp.1–26.

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1 Introduction

In increasingly volatile and complex markets, firms face mounting managerial pressure to redesign marketing channels that can respond effectively to shifting customer expectations, competitive dynamics, and operational disruptions. Competition is no longer determined solely by distribution coverage or transactional efficiency. Instead, firms are required to coordinate digital interfaces, customer interactions, and operational responses across interconnected touchpoints and service processes. Under such conditions, dynamic marketing channel performance has emerged as a critical outcome, reflecting the extent to which firms can align market-facing activities with responsive operational execution. The shift toward interconnected digital, customer, and operational systems underscores the growing importance of integrating marketing and operations management perspectives to explain channel performance in contemporary environments (Verhoef et al., 2021; Robertsone and Lapiņa, 2023; Muthaffar et al., 2024).

Digital marketing plays a central role in enabling such integration by enhancing firms' ability to sense market signals, personalise communication, and sustain interaction across digitally mediated environments. Customer engagement has similarly become a key construct in interactive and socially connected contexts, as it strengthens relational exchanges and supports downstream customer responses (Lim and Rasul, 2022; Roy et al., 2023). However, customer-facing capabilities alone are insufficient to ensure effective channel performance. Effective channel performance depends on the alignment of demand-side responsiveness with operational execution. Recent research indicates that agility and flexibility are essential in the face of uncertainty and rapid change. Supply chain technology capabilities contribute to resilience and agility, while broader work confirms the importance of agility and flexibility in enabling organisational adaptation across competitive contexts (Christofi et al., 2021; Akram et al., 2024). From an operations management perspective, channel performance therefore depends on how effectively firms translate market intelligence into coordinated supply-side and logistics responses.

The broader market environment further reinforces the strategic importance of this issue. The continued expansion of digital commerce has accelerated the need for integrated channel systems, while customers increasingly expect seamless omnichannel experiences rather than isolated channel performance. As a result, cross-channel integration has become a strategic priority requiring coordination among marketing, operations, and logistics functions (McKinsey & Company, 2023). Firms operating in such environments require developed channel systems that are not only connected and adaptive but also operationally responsive and capable of sustaining performance under changing conditions.

Thailand provides a relevant context for examining these dynamics. Forecasts indicate that Thailand's digital economy will reach $56 billion in 2025, driven by e-commerce and digital services (Google et al., 2025). Such growth follows strong market performance in 2023, when the Electronic Transactions Development Agency reported an e-commerce value of 5.96 trillion baht (ETDA, 2024). Market expansion has been supported by rapid adoption of 5G technologies, integrated e-payment systems, and increasingly automated logistics infrastructure (US Commercial Service, 2026). Empirical evidence in the Thai logistics context further indicates that digital transformation, smart logistics capability, and service responsiveness are becoming central to operational competitiveness (Setthachotsombut et al., 2024; Areerakulkan and

Sumrit, 2025). Related work also highlights the role of agile marketing, innovation, and dynamic business management in strengthening organisational competitiveness under changing market conditions (Sukhawatthanakun and Supapon, 2024).

Despite the growth of related research streams, the literature remains fragmented. Studies on digital transformation have emphasised technology-enabled organisational renewal. At the same time, customer engagement research has focused on relational outcomes, and supply chain research has concentrated on agility, resilience, and operational responsiveness. An integrated explanation of how digital, relational, and operational capabilities jointly drive dynamic marketing channel performance remains underdeveloped. The limitation is particularly important in contexts where firms operate through independent channel partners and must align communication and distribution decisions. From a manufacturer's perspective, communication and distribution channels involve distinct strategic considerations, with distribution decisions directly affecting channel structure, incentives, and executional control (Ailawadi, 2021). Existing studies explain important elements of channel adaptation but do not sufficiently clarify how upstream digital capabilities are translated into downstream performance outcomes through coordinated cross-functional mechanisms. Although prior studies have examined digital transformation, customer engagement, supply chain agility, logistics flexibility, and omnichannel performance as separate research streams, limited attention has been paid to how these capabilities operate together as an integrated process linking market sensing, customer interaction, supply-side coordination, and logistics execution. This study differs from prior work by positioning dynamic marketing channel performance as an operationally enabled capability outcome rather than as a purely marketing or digital-transformation outcome.

Building on the dynamic capabilities perspective, which emphasises sensing, alignment, and reconfiguration across organisational functions, dynamic marketing channel performance can be understood as an operationally enabled outcome of integrated capabilities rather than isolated functional improvements (Teece et al., 1997; Teece, 2007; Verhoef et al., 2021; Cui et al., 2022; Lim and Rasul, 2022; Cai and Choi, 2023; Akram et al., 2024). The dynamic capabilities perspective suggests that firms achieve superior channel performance when digital marketing enhances market sensing, supply chain agility supports rapid coordination, and flexible logistics ensure reliable execution. Against this background, the present study examines how digital marketing, customer engagement, supply chain agility, and flexible logistics operate as capability drivers of dynamic marketing channel performance in Thailand. The study reconceptualises channel performance as a capability-based outcome, proposes an integrated explanatory framework, and provides empirical evidence from an emerging-market context characterised by market complexity and operational challenges.

This study contributes to research on services and operations management in three ways. First, it reframes dynamic marketing channel performance as an operationally enabled capability outcome shaped by multiple capability drivers. Second, it explains how digital marketing enhances channel performance by driving customer engagement and enabling supply chain agility. Third, it integrates supply chain agility and flexible logistics into a unified framework that links market-facing digital capability with operational execution and performance.

2 Literature review and hypotheses development

2.1 Digital marketing and customer engagement

Digital marketing has evolved into a strategic capability that enables firms to process market information, sense shifts in demand, and coordinate customer interactions across multiple digital interfaces. In contemporary service and retail environments, digital marketing extends beyond communication efficiency to function as an information-processing mechanism that enables real-time interaction, personalisation, and adaptive response to customer behaviour. Customers increasingly interact with firms through websites, social media platforms, mobile applications, and automated systems, and these touchpoints are integrated into broader omnichannel journeys rather than isolated interactions (Muthaffar et al., 2024).

From an operations management perspective, digital marketing enhances customer engagement by improving the timeliness, relevance, and continuity of interactions across customer touchpoints. Customer engagement reflects the intensity of cognitive, emotional, and behavioural investment in firm-customer interactions and plays a central role in strengthening relational exchanges in digitally mediated environments (Lim and Rasul, 2022; Roy et al., 2023; Rahman et al., 2025). Digital marketing capability enables firms to manage these interactions more effectively by aligning communication content with customer preferences and behavioural patterns in real-time. In this context, digital marketing enhances customer engagement by strengthening the firm's ability to coordinate interactions and deliver consistent, personalised experiences across channels. Such capability is particularly important for improving dynamic marketing channel performance, as engagement provides continuous feedback and interaction data to support adaptive decision-making. Accordingly, the following hypothesis is proposed.

H1 Digital marketing positively affects customer engagement.

2.2 Digital marketing and supply chain agility

Digital marketing also contributes to operational performance by improving firms' ability to access demand-side information and interpret market signals in real-time. In data-rich environments, digital marketing systems enhance visibility into customer preferences, demand fluctuations, and channel activity, thereby strengthening the firm's capacity to respond to changing conditions. From an operations perspective, this informational advantage supports faster coordination between demand signals and supply-side decisions (Verhoef et al., 2021).

Recent research highlights the close linkage between digital capabilities and organisational agility. Supply chain technology capabilities enhance responsiveness and resilience, while digital transformation strengthens enterprise agility by enabling faster sensing and resource reconfiguration (Akram et al., 2024; Al Jabri et al., 2024). Evidence from emerging markets further indicates that digital marketing and sales transformation reshape organisational responsiveness beyond communication functions alone (Gupta et al., 2021). In the Thai context, digital transformation has been shown to enhance logistics responsiveness and operational adaptation, reinforcing the role of digital capability in supporting agile supply chain processes (Areerakulkan and Sumrit, 2025; Hou et al., 2025).

Digital marketing can therefore be conceptualised as an upstream capability that supports supply chain agility by providing timely and accurate demand information, enabling firms to adjust sourcing, production, and distribution decisions more effectively. The alignment between market sensing and operational coordination is critical for improving channel performance under dynamic conditions. Accordingly, the following hypothesis is proposed.

H2 Digital marketing positively affects supply chain agility.

2.3 Customer engagement and dynamic marketing channel performance

Dynamic marketing channel performance depends on the firm's ability to align customer interaction processes with responsive channel execution. Customer engagement plays a critical role in this process because engaged customers generate richer feedback, more frequent interaction, and stronger participation across channels. Customer interactions improve the quality of market information available to firms and support more adaptive channel decisions (Lee et al., 2019).

Prior research indicates that engagement is closely associated with channel integration and the quality of the customer experience, as customer experience management emphasises coordinating touchpoints across the customer journey (Homburg et al., 2017). Channel integration quality strengthens engagement and contributes to favourable behavioural outcomes, including loyalty and participation (Lee et al., 2019; Gao and Huang, 2021). In omnichannel environments, richer interaction and greater continuity across touchpoints enhance engagement and improve the effectiveness of channel coordination (Cui et al., 2022; Rahman et al., 2025). From an operations perspective, customer engagement functions not only as a relational outcome but also as an input to adaptive channel performance. Engagement provides real-time information that enables firms to refine channel configuration, adjust communication strategies, and improve service responsiveness. As a result, stronger customer engagement is expected to enhance dynamic marketing channel performance. Accordingly, the following hypothesis is proposed.

H3 Customer engagement positively affects dynamic marketing channel performance.

2.4 Supply chain agility and flexible logistics

Supply chain agility refers to the firm's ability to sense and respond to changes in demand and operating conditions through rapid coordination and adjustment. Flexible logistics represents the executional capability that enables firms to adapt transportation, inventory, and fulfilment processes to changing circumstances. From an operations management perspective, agility provides the coordination mechanism, while logistics flexibility represents its operational realisation (Christofi et al., 2021).

Empirical research supports the close relationship between agility and flexibility. Agility enables firms to respond to uncertainty, while flexibility allows firms to implement these responses through adaptable logistics processes (Shekarian et al., 2020; Christofi et al., 2021). Technology-enabled supply chains further enhance this relationship by improving the efficiency of coordination and responsiveness under turbulent conditions (Akram et al., 2024). Evidence from online retailing and logistics

management also highlights the importance of aligning response speed with execution quality to achieve effective performance outcomes (Taheri et al., 2024; Bhagwat and Attri, 2026).

In this context, supply chain agility enables firms to reconfigure logistics resources, adjust delivery processes, and maintain service continuity under changing conditions. As a result, higher levels of supply chain agility are expected to enhance logistics flexibility. Accordingly, the following hypothesis is proposed.

H4 Supply chain agility positively affects flexible logistics.

2.5 Supply chain agility and dynamic marketing channel performance

Supply chain agility directly contributes to dynamic marketing channel performance by enabling firms to align operational execution with market-facing activities. Effective channel performance requires timely product availability, reliable fulfilment, and rapid response to demand changes. Without supply chain agility, channel adaptation may remain limited to communication-level adjustments rather than operational responsiveness (Akram et al., 2024).

The importance of this relationship is particularly evident in contexts where firms operate through multiple channel partners. Distribution decisions involve coordinating inventory, pricing, incentives, and logistics execution, all of which require agile supply chain processes to ensure effective channel performance (Ailawadi, 2021). Recent research further indicates that agility enhances competitiveness by improving coordination and adaptation across integrated channel systems (Cai and Choi, 2023).

From an operations perspective, supply chain agility represents a critical capability that links market sensing with executional responsiveness. Firms with higher agility are better positioned to align supply-side processes with customer demand and improve channel performance. Accordingly, the following hypothesis is proposed.

H5 Supply chain agility positively affects dynamic marketing channel performance.

2.6 Flexible logistics and dynamic marketing channel performance

Flexible logistics underpins dynamic marketing channel performance. Modern channel environments require firms to respond to variations in order volume, delivery requirements, and customer expectations across multiple channels. Logistics flexibility enables firms to adjust fulfilment processes, delivery schedules, and inventory allocation in response to such changes (Sumrit and Sowijit, 2023).

Empirical evidence supports the importance of logistics capability in shaping performance outcomes. Logistics service quality has been shown to influence customer satisfaction and loyalty, indicating that execution quality is a key determinant of channel effectiveness (Yoganandan et al., 2024). Research in omnichannel retailing further suggests that successful channel performance depends on the coordinated management of delivery time, cost efficiency, and customer satisfaction (Taheri et al., 2024). Additionally, firms achieve channel transformation through combinations of logistics efficiency, customer engagement, and dynamic capabilities (Febriani et al., 2025).

From an operations management perspective, flexible logistics converts adaptive channel strategies into reliable execution. Firms with higher logistics flexibility are better

able to sustain service performance, improve responsiveness, and enhance overall channel effectiveness. Accordingly, the following hypothesis is proposed.

H6 Flexible logistics positively affects dynamic marketing channel performance.

2.7 Business type as a grouping variable

Business type is incorporated in this study as a grouping variable to examine whether evaluations of the major constructs differ between industrial and trading businesses. The distinction between industrial and trading businesses is relevant from an operations management perspective because firms in different business contexts rely on different combinations of customer interaction, sourcing coordination, inventory logic, logistics execution, and channel responsiveness. Industrial businesses tend to place greater emphasis on production coordination, supplier relationships, inventory planning, and logistics continuity. In contrast, trading businesses depend more heavily on assortment management, customer interface intensity, channel interaction, and market responsiveness.

Prior research indicates that agility, flexibility, and digital transformation pathways may vary across organisational and market contexts. Competitive and international conditions shape how firms develop agility and flexibility, while firms progress toward omnichannel transformation through different patterns of capability deployment that depend on context and resource configuration (Christofi et al., 2021; Febriani et al., 2025). In this study, business type is therefore used to assess whether industrial and trading businesses differ in their evaluations of digital marketing, customer engagement, supply chain agility, flexible logistics, and dynamic marketing channel performance. Accordingly, the following hypothesis is proposed.

H7 Business type differentiates the evaluation of the major constructs between industrial businesses and trading businesses.

2.8 Conceptual framework

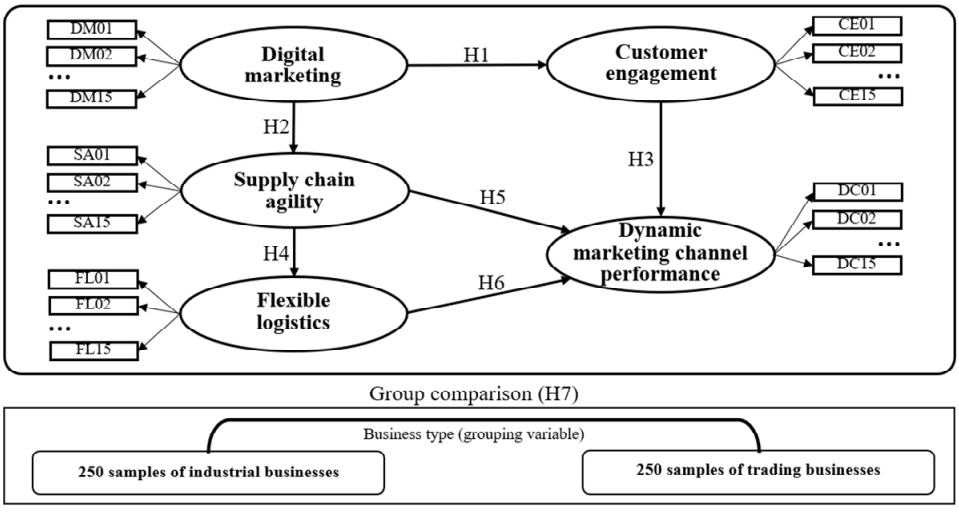
The conceptual framework is grounded in the view that dynamic marketing channel performance emerges from the integration of digital, relational, and operational capabilities. Digital marketing is positioned as an upstream capability that strengthens customer engagement and supply chain agility. Customer engagement contributes to dynamic marketing channel performance by enhancing interaction continuity, feedback quality, and customer-informed responsiveness. Supply chain agility contributes both directly to dynamic marketing channel performance and indirectly through flexible logistics, while flexible logistics enables channel performance through responsive fulfilment, delivery adaptation, and operational reliability.

In this study, digital marketing and dynamic marketing channel performance are conceptually distinct, although both constructs involve digital technologies. Digital marketing refers to the firm's upstream capability to use digital tools, artificial intelligence, automation, analytics, and platform-based communication to sense customer needs, personalise communication, and manage market-facing interactions (Verhoef et al., 2021; Muthaffar et al., 2024). By contrast, dynamic marketing channel performance refers to the downstream performance outcome of the channel system,

reflected in the firm's ability to adjust channel configuration, integrate cross-channel data, optimise customer journeys, and respond effectively across marketing channels (Ailawadi, 2021; Cai and Choi, 2023). Therefore, digital marketing is treated as an enabling capability. In contrast, dynamic marketing channel performance is defined as the adaptive performance outcome resulting from the alignment of digital, relational, supply chain, and logistics capabilities (Teece, 2007; Akram et al., 2024).

Business type is incorporated as a grouping variable to examine whether industrial and trading businesses differ in their evaluations of the major constructs. The framework, therefore, supports the argument that firms improve dynamic marketing channel performance by coordinating capability alignment amid market complexity. This logic is consistent with the dynamic capabilities view of sensing, coordination, and reconfiguration across organisational functions (Teece et al., 1997; Teece, 2007; Al Jabri et al., 2024; Febriani et al., 2025). Figure 1 presents the study's conceptual framework.

Figure 1 Conceptual framework of dynamic marketing channel performance



3 Methodology

3.1 Research design

The study employed a quantitative research design to examine the relationships among digital marketing, customer engagement, supply chain agility, flexible logistics, and dynamic marketing channel performance in Thailand. A quantitative approach was appropriate because the study sought to test theoretically specified relationships among latent constructs through standardised measures and statistical modelling (Creswell and Creswell, 2018).

Structural equation modelling was adopted as the principal analytical technique because the proposed framework comprised multiple interrelated relationships among latent constructs. SEM enabled the assessment of the measurement model before estimating the structural relationships, allowing the capability-integration framework to

be evaluated within a single analytical system rather than through separate regression-based tests. The analytical logic is consistent with established methodological guidance for covariance-based SEM in theory-testing research (Byrne, 2016; Kline, 2016; Hair et al., 2019).

3.2 Population and sample

The study population consisted of business operators in Thailand. The empirical design covered two business contexts relevant to contemporary channel and operations management: industrial businesses and trading businesses. The final sample comprised 500 firms, divided equally between 250 industrial and 250 trading businesses, to support a balanced comparison between the two groups.

Sample selection followed a multistage procedure. Thailand was first divided into five regional strata: Bangkok and its metropolitan area, the Central region, the Northern region, the Northeastern region, and the Southern region. Provinces with the largest numbers of registered businesses in each region were then identified using provincial business registration statistics, and the top three provinces in each region were selected as the main survey locations (Department of Business Development, 2024). Quota sampling was subsequently used within the selected provinces to allocate the sample across the targeted business groups. Approximately 600 questionnaires were distributed, of which 500 valid responses were retained for analysis.

The sample size was sufficient for confirmatory factor analysis and covariance-based SEM. Prior methodological literature indicates that SEM requires a sufficiently large sample size to support stable parameter estimates and reliable model assessment when multiple latent constructs and observed indicators are involved (Kline, 2016; Hair et al., 2019). Given the five latent constructs and the broad initial measurement structure, 500 valid firm-level responses provided an adequate basis for model estimation and hypothesis testing.

The unit of analysis was the firm. Respondents were owners, executives, managers, or responsible personnel with sufficient knowledge of the firm's channel management, digital marketing activities, customer-related practices, supply chain coordination, and logistics responsiveness. This respondent logic was intended to strengthen the validity of the firm-level data used in the analysis (Creswell and Creswell, 2018).

3.3 Research instrument

The research instrument was a structured questionnaire designed to measure the five latent constructs in the conceptual framework. The questionnaire comprised four parts: general business information; business operations and marketing channel management; construct measurement items; and open-ended opinions and recommendations. The construct measurement section initially contained 75 items, with 15 indicators for each construct covering digital marketing, customer engagement, supply chain agility, flexible logistics, and dynamic marketing channel performance.

All construct measurement items were assessed using a five-point perceived importance scale, ranging from 1 (least important) to 5 (most important). Respondents evaluated the importance of each practice, capability, or channel-management activity for their firm's marketing channel management under dynamic market conditions. Structured

questionnaires are appropriate for explanatory quantitative research because they translate theoretical constructs into observable indicators for multivariate analysis and hypothesis testing (Creswell and Creswell, 2018; Hair et al., 2019).

Content validity was assessed using the item objective congruence (IOC) technique. Five academic and industry experts evaluated item relevance, with IOC values ranging from 0.60 to 1.00. The instrument was revised in accordance with the experts' recommendations before the tryout stage. A tryout with 30 respondents was conducted to assess item clarity and preliminary reliability. The initial 75-item instrument produced a Cronbach's alpha coefficient of 0.978, indicating satisfactory internal consistency before the main data collection.

Before the final analysis, the measurement model was refined from the initial 75 indicators to 28 retained indicators across the five constructs. The refinement process considered item reliability, internal consistency, factor suitability, standardised factor loadings, squared multiple correlations, statistical significance, conceptual clarity, and overall model fit. Indicators were excluded when they showed weak measurement contribution, conceptual redundancy, or limited contribution to model parsimony. The final retained set preserved adequate construct coverage while achieving satisfactory measurement and structural model fit. Detailed retained indicators, standardised loadings, and squared multiple correlations are reported in Table A3.

3.4 Data collection procedure and ethical considerations

Data collection followed a structured survey procedure. The questionnaire package included an introduction to the study, participant information, and a statement emphasising voluntary participation and confidentiality. Respondents were informed that the study focused on business operators in Thailand, that completion would require approximately 50 minutes, and that all data would be used solely for academic purposes and reported only in aggregate form.

The survey was administered to eligible business respondents who could provide firm-level information on marketing channel management, digital marketing practices, customer-related processes, supply chain coordination, and logistics responsiveness. Completed questionnaires were screened prior to analysis, and 500 usable cases were retained for descriptive and inferential analyses.

The questionnaire and research proposal received approval from the Kasetsart University Ethics Committee under the Study Code No. KUREC-CSC68-016 and COE No. COE68/012. Participants were informed that they could refuse to answer any question and withdraw from the study at any time without consequence. No individual respondent or organisation was identified in the reported findings. The study followed standard ethical principles for survey-based research, including informed consent, confidentiality, and respect for participant autonomy (Creswell and Creswell, 2018).

3.5 Data analysis

Data were analysed using descriptive and inferential statistical techniques. Descriptive statistics were used to summarise respondent and organisational characteristics, including the respondent profile and the general features of business operations and channel management practices.

Inferential analysis proceeded in several stages. Preliminary diagnostics first assessed the dataset's suitability for factor analysis. Confirmatory factor analysis was then used to evaluate the adequacy of the measurement model and the correspondence between observed indicators and latent constructs. The structural model was subsequently estimated to test the hypothesised direct effects among digital marketing, customer engagement, supply chain agility, flexible logistics, and dynamic marketing channel performance. The analytical sequence is consistent with established practice in covariance-based SEM for theory-testing research involving latent constructs (Byrne, 2016; Kline, 2016; Hair et al., 2019).

Business type was also included as a grouping variable, and an independent-samples t-test was conducted to compare the mean scores of the principal study variables across industrial and trading businesses. The additional analysis was intended to assess whether the general pattern of construct evaluation differed across the two business contexts, consistent with established comparative procedures for examining mean differences between independent groups (Creswell and Creswell, 2018; Hair et al., 2019).

4 Results

4.1 Respondent profile

The sample was divided equally between industrial and trading businesses, with 250 firms in each group, representing 50.0% of the total sample. Within the industrial business category, the other consumer goods industry recorded the highest proportion at 32.8%, whereas e-commerce businesses without storefronts had the largest share in the trading business category at 32.4%. Medium-sized businesses constituted the largest organisational size group at 47.2%. Limited companies were the most common business form, accounting for 45.4%. Firms operating for 11–15 years accounted for the highest proportion at 31.6%, and domestic business represented the largest scope of operation at 39.0%. Overall, the sample was dominated by medium-sized, relatively established firms, with a substantial share operating in domestic markets. Detailed respondent and firm characteristics are reported in Table A1.

4.2 Business operations and channel management profile

The results show that integrated channels constituted the most common main marketing channel format at 30.4%. Partial strategy adoption to support channel management recorded the highest proportion at 25.0%, followed closely by full-scale use with AI or big data at 24.8%. Customer relationship management systems were the most frequently used technology in channel management at 25.8%. Occasional adjustments when market conditions change accounted for the largest share of channel strategy adjustments at 29.8%, followed by real-time adjustments using AI and big data at 25.6%. Moderate flexibility was the most common level of market response at 25.4%. Limited customer data use accounted for the highest proportion at 40.2%. The lack of accurate customer data was identified as the most important challenge in channel management, at 30.4%. No specific logistics strategy recorded the highest proportion at 30.6%. Increasing sales and expanding the customer base were the most important factors in channel management, accounting for 30.6% of the total. Finally, developing digital technology

for sales channels represented the largest area of future investment at 29.2%. Taken together, these findings suggest that many firms are already moving toward integrated channel systems, yet continue to face important data and logistics constraints in translating channel integration into adaptive performance. Detailed descriptive results for business operations and marketing channel management practices are reported in Table A2.

4.3 Measurement and structural model results

Preliminary diagnostics indicated that the dataset was appropriate for latent-variable modelling. The Kaiser-Meyer-Olkin measure of sampling adequacy was 0.981, indicating a highly suitable data structure for factor-based analysis. In addition, Bartlett's test of sphericity was statistically significant (approx. χ^2 = 29,101.245, df = 2,775, $p < 0.001$), confirming that the correlation matrix was appropriate for subsequent model estimation.

Descriptive statistics and bivariate correlations are presented in Table 1. The mean scores of the five latent constructs ranged from 4.434 to 4.530, indicating generally high evaluations across the major study variables. All correlations were positive and statistically significant at the 0.001 level, with coefficients ranging from 0.334 to 0.710. The correlation results provide preliminary support for the expected positive associations among digital marketing, customer engagement, supply chain agility, flexible logistics, and dynamic marketing channel performance.

Table 1 Descriptive statistics and correlations

Variable		*Mean*	*SD*	*1*	*2*	*3*	*4*	*5*
1	Digital marketing	4.530	0.381	1.000				
2	Customer engagement	4.519	0.373	0.677***	1.000			
3	Supply chain agility	4.521	0.380	0.620***	0.484***	1.000		
4	Flexible logistics	4.526	0.413	0.459***	0.334***	0.573***	1.000	
5	Dynamic marketing channel performance	4.434	0.537	0.645***	0.654***	0.710***	0.678***	1.000

Note: ***$p < 0.001$.

The measurement model was then assessed using confirmatory factor analysis. As shown in Figure 2, the final model provided a good fit to the data, with χ^2 = 377.234, df = 344, $p = 0.105$, and $\chi^2/df = 1.097$. The goodness-of-fit indices were also satisfactory, including GFI = 0.949, AGFI = 0.940, CFI = 0.996, TLI = 0.996, and RMSEA = 0.014. The final model retained 28 observed variables across the five constructs, and all standardised factor loadings were positive and statistically significant at $p < 0.001$. Detailed retained indicators, standardised loadings, and squared multiple correlations are reported in Table A3.

Reliability and validity were also assessed for the final measurement model. As reported in Table 2, Cronbach's alpha values ranged from 0.822 to 0.881, exceeding the recommended threshold of 0.70. Composite reliability values ranged from 0.842 to 0.948, indicating adequate internal consistency. The average variance extracted values ranged from 0.508 to 0.724, confirming convergent validity, as all exceeded 0.50. Discriminant validity was also supported according to the Fornell-Larcker criterion, as the square root of AVE for each construct was greater than its correlations with other constructs (Fornell

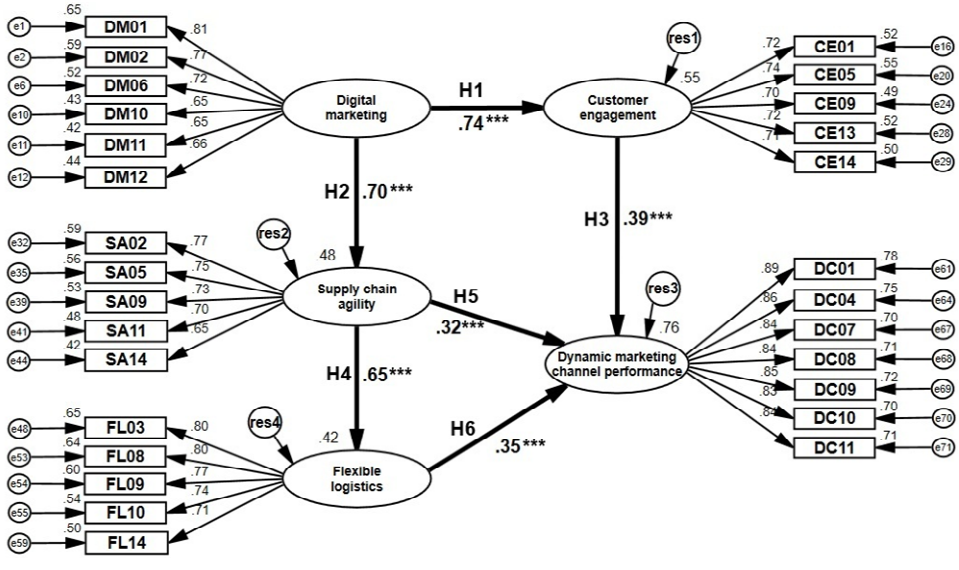
and Larcker, 1981). The highest inter-construct correlation was 0.710 between supply chain agility and dynamic marketing channel performance, which remained below the square root of AVE for both constructs. The reliability and validity results indicate that the retained indicators demonstrate acceptable reliability, convergent validity, and discriminant validity for subsequent structural model testing.

Table 2 Measurement model reliability and validity

Construct	*Retained items*	*Cronbach's alpha*	*Composite reliability*	*AVE*	$\sqrt{AVE}$
Digital marketing	6	0.852	0.860	0.508	0.713
Customer engagement	5	0.844	0.843	0.517	0.719
Supply chain agility	5	0.822	0.842	0.518	0.719
Flexible logistics	5	0.847	0.876	0.586	0.766
Dynamic marketing channel performance	7	0.881	0.948	0.724	0.851

Notes: AVE = average variance extracted; $\sqrt{\text{AVE}}$ = square root of AVE. Composite reliability and AVE were computed from the standardised factor loadings of the retained indicators reported in Table A3.

Figure 2 Structural model of dynamic marketing channel performance



The structural model was subsequently estimated to test the hypothesised relationships among the five constructs. The standardised path coefficients showed that digital marketing had significant positive effects on customer engagement ($\beta = 0.741$, $p < 0.001$) and supply chain agility ($\beta = 0.696$, $p < 0.001$). Supply chain agility also had significant positive effects on flexible logistics ($\beta = 0.651$, $p < 0.001$) and dynamic marketing

channel performance ($\beta = 0.324$, $p < 0.001$). In addition, customer engagement positively influenced dynamic marketing channel performance ($\beta = 0.395$, $p < 0.001$), while flexible logistics also exerted a significant positive effect on dynamic marketing channel performance ($\beta = 0.353$, $p < 0.001$).

The squared multiple correlations further showed that the model explained 48.4% of the variance in supply chain agility, 54.8% in customer engagement, 42.4% in flexible logistics, and 75.9% in dynamic marketing channel performance. Overall, the findings support the adequacy of both the measurement and structural models and provide strong empirical support for the proposed framework.

Table 3 Structural equation model fit indices and interpretation

Fit index	*Recommended criterion*	*Obtained value*	*Interpretation*
Chi-square (χ^2)	Lower value preferred	377.234	Acceptable
Degrees of freedom (df)	-	344	-
Probability level (p-value)	>0.05	0.105	Good fit
CMIN/DF	<2.00	1.097	Good fit
GFI	>0.90	0.949	Good fit
AGFI	>0.90	0.940	Good fit
CFI	>0.90	0.996	Excellent fit
TLI	>0.90	0.996	Excellent fit
RMSEA	<0.08	0.014	Excellent fit
RMR	<0.05	0.009	Good fit

Table 4 Final SEM results

Path	*Standardised estimate*	*Unstandardised estimate*	R^2	*SE*	*CR*	*P*
Digital marketing → customer engagement	0.741	0.669	0.548	0.051	13.181	***
Digital marketing → supply chain agility	0.696	0.663	0.484	0.051	13.095	***
Customer engagement → dynamic marketing channel performance	0.395	0.603	0.759	0.062	9.719	***
Supply chain agility → flexible logistics	0.651	0.708	0.424	0.058	12.247	***
Supply chain agility → dynamic marketing channel performance	0.324	0.469	0.759	0.072	6.549	***
Flexible logistics → dynamic marketing channel performance	0.353	0.470	0.759	0.058	8.178	***

Notes: R^2 values refer to the explained variance of the endogenous construct associated with each path. The same R^2 value is repeated for paths sharing the same endogenous construct.

4.4 Summary of hypothesis testing results

The hypothesis testing results provided strong support for the proposed structural model. All six structural relationships were positive and statistically significant at the 0.001 level. Digital marketing had significant positive effects on customer engagement and supply chain agility. Supply chain agility also exerted significant positive effects on flexible logistics and dynamic marketing channel performance. In addition, customer engagement and flexible logistics both had significant positive effects on dynamic marketing channel performance. However, H7 was not supported because the independent-samples t-test showed no statistically significant differences between industrial and trading businesses in their evaluations of the major constructs.

Table 5 Hypothesis testing results

Hypothesis	*Path*	*Standardised estimate (β)*	*Result*
H1	Digital marketing → customer engagement	0.741	Supported
H2	Digital marketing → supply chain agility	0.696	Supported
H3	Customer engagement → dynamic marketing channel performance	0.395	Supported
H4	Supply chain agility → flexible logistics	0.651	Supported
H5	Supply chain agility → dynamic marketing channel performance	0.324	Supported
H6	Flexible logistics → dynamic marketing channel performance	0.353	Supported
H7	Business type differentiates evaluations of the major constructs between industrial businesses and trading businesses	-	Not supported

Notes: All structural paths for H1–H6 were significant at $p < 0.001$. H7 was tested using an independent-samples t-test and was not supported.

4.5 Group comparison by business type

An independent-samples t-test was conducted to compare the mean scores of industrial businesses and trading businesses across the major constructs in the proposed framework. The results showed that industrial businesses reported slightly higher mean scores than trading businesses for digital marketing ($M = 4.54$ vs. 4.52, $p = 0.491$), customer engagement ($M = 4.54$ vs. 4.50, $p = 0.183$), supply chain agility ($M = 4.54$ vs. 4.50, $p = 0.185$), flexible logistics ($M = 4.54$ vs. 4.51, $p = 0.331$), and dynamic marketing channel performance ($M = 4.47$ vs. 4.40, $p = 0.104$). However, none of these differences was statistically significant. The group-comparison findings indicate that business type did not lead to significant differences in the overall evaluation of the study's major constructs, suggesting that the proposed capability framework was perceived similarly by both industrial and trading businesses.

5 Discussion

The findings support the central argument that dynamic marketing channel performance is shaped by the integration of digital, relational, supply-side, and logistics capabilities rather than by isolated functional improvements. All hypothesised relationships were positive and statistically significant, and the model explained 75.9% of the variance in dynamic marketing channel performance. The structural pattern provides the study's strongest empirical insight: channel performance in complex markets depends on the coordinated alignment of market sensing, customer interaction, supply chain responsiveness, and logistics execution. This result is consistent with the dynamic capabilities perspective, which views organisational adaptation as a process of sensing, coordination, and reconfiguration across connected functions (Teece et al., 1997; Teece, 2007; Verhoef et al., 2021; Hou et al., 2025). Thai evidence also supports the view that adaptive business performance is strengthened through coordinated capability development across marketing, innovation, and managerial domains (Sukhawatthanakun and Supapon, 2024).

The significant effects of digital marketing on customer engagement and supply chain agility are important for explaining how firms improve channel performance. The stronger effect on customer engagement suggests that digital marketing primarily operates as a relational and interactional capability. Digital marketing enables firms to communicate with customers in a timely, relevant, and continuous manner across digital touchpoints. This interpretation is consistent with prior research indicating that digitally mediated interaction strengthens engagement through responsiveness, relevance, and continuity in customer-firm exchanges (Lim and Rasul, 2022; Roy et al., 2023; Rahman et al., 2025). At the same time, the positive effect on supply chain agility indicates that digital marketing also functions as a demand-sensing capability. Digital marketing helps firms detect shifts in customer behaviour, interpret market signals, and translate demand-side information into operational responses. This finding extends the role of digital marketing beyond communication efficiency, showing that digital capability contributes to organisational responsiveness by improving visibility and coordination (Ailawadi, 2021; Gupta et al., 2021; Akram et al., 2024; Al Jabri et al., 2024).

Supply chain agility had significant positive effects on both flexible logistics and dynamic marketing channel performance. This result indicates that agility serves as a bridge between market sensing and operational execution. Firms with stronger supply chain agility are better able to coordinate sourcing, planning, inventory adjustment, and operational response in line with changing market conditions. The positive effect on flexible logistics confirms that agile supply chain processes provide the coordination foundation for adaptive logistics execution. The direct effect on dynamic marketing channel performance further indicates that channel performance depends not only on customer-facing intelligence but also on the firm's capacity to coordinate execution across interconnected market and operational systems. This interpretation is consistent with research on omnichannel strategy and recent evidence showing that logistics-related capabilities strengthen executional adaptation and organisational performance across Thai and online retail contexts (Cai and Choi, 2023; Akram et al., 2024; Setthachotsombut et al., 2024; Yoganandan et al., 2024; Areerakulkan and Sumrit, 2025; Bhagwat and Attri, 2026).

Customer engagement and flexible logistics also showed significant positive effects on dynamic marketing channel performance. The effect of customer engagement

confirms that channel performance improves when firms maintain richer interaction, stronger feedback flows, and deeper customer participation across channel interfaces. Customer engagement, therefore, functions not only as an outcome of channel quality but also as an informational and relational input that supports channel adaptation over time (Lee et al., 2019; Gao and Huang, 2021; Cui et al., 2022). The positive effect of flexible logistics further indicates that channel adaptation becomes strategically meaningful only when firms translate adaptive decisions into dependable execution. Dynamic marketing channel performance, therefore, requires both customer-informed responsiveness and logistics-enabled operational reliability. This result is consistent with prior work linking omnichannel transformation and service continuity to logistics efficiency, coordination routines, and dynamic capabilities (Sumrit and Sowijit, 2023; Taheri et al., 2024; Febriani et al., 2025).

The relative size of the direct effects provides further insight into the capability structure of dynamic marketing channel performance. Customer engagement showed the strongest direct effect on dynamic marketing channel performance ($\beta = 0.395$), followed by flexible logistics ($\beta = 0.353$) and supply chain agility ($\beta = 0.324$). This pattern suggests that channel performance is most directly strengthened by the quality of customer interactions and the continuity of feedback, while logistics flexibility provides the executional reliability needed to translate adaptive decisions into service outcomes. Supply chain agility remains strategically important because it supports both direct channel responsiveness and the development of flexible logistics. Therefore, the results indicate that relational responsiveness, logistics execution, and supply-side agility operate as complementary mechanisms rather than competing drivers of dynamic marketing channel performance.

Taken together, the structural pattern reveals an operations-oriented capability process. Digital marketing operates as an upstream capability that strengthens customer engagement and supply chain agility. Supply chain agility then supports flexible logistics and contributes directly to dynamic marketing channel performance, while customer engagement and flexible logistics act as immediate drivers of channel performance. The layered capability process suggests that firms strengthen channel performance when digital market sensing is connected with customer interaction, supply-side coordination, and logistics execution. Dynamic marketing channel performance is therefore best understood as an operationally enabled capability outcome rather than a purely marketing-oriented result (Teece, 2007; Verhoef et al., 2021).

The comparison between industrial and trading businesses showed no statistically significant differences in their mean evaluations of the major constructs. This result suggests that the capability logic underlying dynamic marketing channel performance is broadly relevant across both business contexts. Digital, relational, supply-side, and logistics integration appear to have become common managerial requirements for firms seeking stronger channel responsiveness in Thailand. For decision-makers, the absence of group differences suggests that the proposed capability-integration framework can guide improvements in channel performance across multiple business types. However, implementation priorities may still vary according to industry structure, resource availability, channel configuration, and operational complexity.

6 Theoretical implications

This study contributes to the services and operations management literature by repositioning dynamic marketing channel performance as an outcome of integrated capabilities rather than as a purely marketing-oriented construct. First, the findings extend existing research by demonstrating that channel performance arises from the coordinated interplay among digital marketing, customer engagement, supply chain agility, and flexible logistics. Prior studies have often examined these constructs in isolation within separate research streams. The present study integrates them into a single structural framework and shows that channel performance is better explained as an emergent outcome of interconnected capabilities operating across market-facing and operational domains (Teece, 2007; Verhoef et al., 2021; Cui et al., 2022).

Second, the study refines capability-based reasoning by clarifying the role of digital marketing as an upstream capability that influences both relational and operational processes. The findings indicate that digital marketing enhances customer engagement and strengthens supply chain agility. The dual role of digital marketing suggests that digital marketing contributes to performance not only through communication and interaction but also by supporting demand sensing and coordination. The interpretation aligns with the dynamic capabilities view, which emphasises the integration of sensing and reconfiguration processes across organisational functions (Teece, 2007; Verhoef et al., 2021).

Third, the study contributes to operations management theory by highlighting the central role of supply chain agility and flexible logistics in shaping channel performance. The significant relationships among supply chain agility, flexible logistics, and dynamic marketing channel performance indicate that operational responsiveness and execution capability are not peripheral but central to explaining market-facing performance outcomes. This finding extends prior research by integrating demand-side interaction and supply-side execution within a unified explanatory framework (Akram et al., 2024; Taheri et al., 2024; Febriani et al., 2025).

Fourth, the study provides a layered explanation of capability integration that connects upstream, midstream, and downstream processes. Digital marketing enhances market sensing and interaction, supply chain agility supports coordination and adaptation, and flexible logistics enables execution and service delivery. This layered structure offers a more comprehensive explanation of how firms translate information and interaction into operational performance outcomes. The layered structure also strengthens the theoretical linkage between marketing and operations by demonstrating that channel performance depends on cross-functional integration rather than isolated capability development (Teece et al., 1997; Teece, 2007).

Finally, the absence of significant differences between industrial and trading businesses suggests that the capability-integration logic underlying dynamic marketing channel performance may have broader theoretical applicability across business contexts. This finding indicates that integrated digital, relational, and operational capabilities constitute a generalisable mechanism for improving channel performance in complex market environments. Accordingly, the proposed framework offers an integrative perspective that bridges marketing and operations management to explain performance outcomes.

7 Managerial implications

The managerial implications are derived directly from the empirical findings. These implications are relevant for firms seeking to improve dynamic marketing channel performance in volatile market environments. First, digital marketing should be managed as a strategic capability that supports both customer interaction and operational coordination. Investment in digital marketing systems should therefore include data analytics, automation, and real-time information processing that enhance customer engagement and supply chain responsiveness.

Second, firms should treat customer engagement, supply chain agility, and flexible logistics as connected elements of channel performance. Customer engagement provides interaction data and feedback to improve channels, while supply chain agility enables rapid coordination of sourcing, inventory, production, and distribution decisions. Flexible logistics then converts adaptive decisions into reliable fulfilment and delivery execution.

Third, the absence of significant differences between industrial and trading businesses suggests that the proposed capability-integration framework can be applied across different business contexts. Managers should therefore focus on aligning digital marketing, customer engagement, supply chain agility, and logistics execution as an integrated decision system rather than as separate functional responsibilities.

In practice, firms can connect digital marketing data with customer engagement systems by integrating customer analytics, CRM platforms, social listening tools, and campaign response data into a shared decision dashboard. The integrated data can then support supply chain planning by improving demand forecasting, inventory allocation, and supplier coordination. At the logistics level, firms can use real-time order information, route optimisation, parcel tracking, and flexible delivery partnerships to adjust fulfilment and delivery decisions more rapidly. For example, customer response data from digital campaigns can be used to anticipate product demand, trigger inventory replenishment, and allocate logistics capacity across online and offline channels. Such integration enables digital marketing to move beyond communication and function as a practical input for operational responsiveness.

8 Conclusions

This study examined how digital marketing, customer engagement, supply chain agility, and flexible logistics jointly contribute to dynamic marketing channel performance in Thailand. The findings confirm that channel performance is strengthened by the coordinated integration of digital, relational, and operational capabilities rather than by isolated functional improvements. The study provides empirical evidence from an emerging-market context and positions dynamic marketing channel performance as an operationally enabled capability outcome.

The study has limitations. The cross-sectional design provides a focused empirical setting but does not capture temporal changes, and its single-country context may limit generalisability. Future research may extend the framework through longitudinal data, cross-country comparisons, and additional capabilities such as data-driven decision-making, innovation capability, and ecosystem-level coordination. Overall, the study contributes to the services and operations management literature by explaining how

capability alignment enables operationally driven market performance in dynamic channel environments.

Acknowledgements

The author would like to thank all respondents who participated in this study for their time and valuable information. The author also gratefully acknowledges the support provided by Kasetsart University, Chalermphrakiat Sakon Nakhon Province Campus, during the conduct of this research.

Declarations

The questionnaire and research proposal received approval from Kasetsart University Ethics Committee under the Study Code No. KUREC-CSC68-016 and COE No. COE68/012. Participants were informed that they could refuse to answer any question and withdraw from the study at any time without consequence. No individual respondent or organisation was identified in the reported findings. The study followed standard ethical principles for survey-based research, including informed consent, confidentiality, and respect for participant autonomy.

During the preparation of this work, the author used ChatGPT and Grammarly solely to improve language, grammar, and sentence structure. The author carefully reviewed, revised, and validated all content after using these tools and takes full responsibility for the final content of the manuscript.

The author declares no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Appendix

Table A1 Respondent profile

Item	*Dominant category*	*n*	*%*	*Other main categories*
Business type	Industrial businesses	250	50.0	Trading businesses 50.0%
Industrial subgroup	Other consumer goods industry	82	32.8	Technology and electronics manufacturing 22.8%; food and beverage manufacturing 22.0%; heavy manufacturing 17.6%; other industrial businesses 4.8%
Trading subgroup	E-commerce businesses without storefronts	81	32.4	Retail businesses 32.0%; wholesale businesses 30.0%; other trading businesses 5.6%
Organisational size	Medium-sized businesses	236	47.2	Large businesses 32.0%; small businesses 20.8%
Business form	Limited company	227	45.4	Sole proprietorship or ordinary partnership 24.2%; limited partnership 17.6%; public company limited 12.8%
Years in operation	11–15 years	158	31.6	5–10 years 26.8%; 16–20 years 17.6%; not more than 5 years 14.0%; more than 20 years 10.0%
Scope of operation	Domestic business	195	39.0	International business 35.8%; both domestic and international 25.2%

Note: n = 500. Percentages are based on valid responses.

Table A2 Business operations and marketing channel management practices

Item		*Dominant response category*	*n*	*%*	*Other main categories*
Q1	Primary marketing channel used	Integrated channels (omnichannel)	152	30.4	Offline channels 25.8%; online channels 22.6%; B2B sales channels 16.8%; other 4.4%
Q2	The extent of strategy adoption to support channel management	Partial use	125	25.0	Full-scale use with AI or big data 24.8%; moderate use 23.2%; comprehensive use 17.2%; no use 9.8%
Q3	Technologies used in marketing channel management	Customer Relationship Management system	129	25.8	Marketing automation system 21.2%; e-commerce platforms 19.4%; customer data analytics system 19.0%; SCM system 14.6%
Q4	Adjustment of marketing channel strategy according to market trends	Adjusts occasionally when market changes occur	149	29.8	Real-time adjustment using AI and big data 25.6%; primarily uses market data analysis 21.2%; continuous adjustment 19.4%; never adjusts 4.0%

Notes: n = 500 for all items. Percentages are based on valid responses.

Table A2 Business operations and marketing channel management practices (continue)

Item		*Dominant response category*	*n*	*%*	*Other main categories*
Q5	Flexibility of channel management in responding to the market	Moderately flexible	127	25.4	Extremely flexible 23.6%; slightly flexible 22.4%; highly flexible 17.6%; no flexibility 11.0%
Q6	Use of customer data to adjust channel strategy	Uses limited customer data	201	40.2	Uses customer data to analyse behaviour and market trends 26.0%; uses real-time customer data 15.4%; uses customer data extensively for personalised channels 14.2%; other 4.2%
Q7	The greatest challenge in marketing channel management is	Lack of accurate customer data	152	30.4	Rapid changes in customer behaviour 21.0%; intense market competition 17.2%; high channel management costs 16.6%; demand and supply uncertainty 14.8%
Q8	Use of logistics strategies to support channel management	No specific logistics strategy is used	153	30.6	Smart logistics strategies using AI, IoT, or big data 21.2%; used only for cost control and delivery 17.0%; used to create competitive advantage 15.8%; used to improve customer responsiveness 15.4%
Q9	The most important factor in marketing channel management	Increasing sales and expanding the customer base	153	30.6	Developing partner networks and collaboration with digital platforms 25.8%; reducing channel management costs 17.2%; creating a positive customer experience 14.8%; developing long-term competitiveness 11.6%
Q10	Area of future investment for channel development	Developing digital technology to support sales channels	146	29.2	Developing and adopting AI and automation 25.8%; improving logistics and supply chain management 17.2%; expanding new sales channels 14.4%; investing in brand building and marketing communication 13.4%

Notes: n = 500 for all items. Percentages are based on valid responses.

Table A3 Retained indicators in the final SEM model

Construct and measurement item		*Mean*	*SD*	*Std. loading*	*SMC*
Digital marketing					
DM01	Using artificial intelligence to analyse customer data for real-time marketing strategy adjustment.	4.52	0.508	0.806	0.650
DM02	Using marketing automation to implement marketing campaigns efficiently and continuously.	4.52	0.516	0.769	0.592
DM06	Developing influencer marketing strategies by using artificial intelligence to identify the most suitable and effective influencers.	4.55	0.502	0.720	0.519
DM10	Using artificial intelligence for customer segmentation to improve targeting accuracy and marketing strategy effectiveness.	4.53	0.503	0.653	0.427
DM11	Developing content marketing strategies suited to each digital platform effectively.	4.52	0.504	0.652	0.425
DM12	Using programmatic advertising to maximise advertising effectiveness through automated and real-time ad placement.	4.52	0.512	0.661	0.438
Customer engagement					
CE01	Increasing customer communication and interaction through multiple channels such as social media, chatbots, and e-mail.	4.53	0.512	0.723	0.523
CE05	Encouraging customers to provide comments or review ratings to enhance brand credibility and image.	4.52	0.512	0.741	0.548
CE09	Using artificial intelligence to recommend products and services that match individual customer needs in real-time.	4.54	0.503	0.702	0.493
CE13	Integrating chatbots and voice AI to improve customer service efficiency and speed.	4.52	0.504	0.723	0.522
CE14	Using marketing automation to deliver real-time messages and promotions aligned with individual customer behaviour.	4.53	0.511	0.707	0.499
Supply chain agility					
SA02	Building long-term relationships with suppliers to strengthen collaboration during crises.	4.50	0.508	0.768	0.590
SA05	Using data analysis systems to forecast raw material demand accurately in advance.	4.51	0.516	0.752	0.565
SA09	Adjusting raw material procurement processes promptly in response to unexpected demand changes.	4.53	0.512	0.726	0.527

Notes: Std. loading = standardised factor loading; SMC = squared multiple correlation. All retained indicators were statistically significant at $p < 0.001$. The mean and SD were calculated from the final set of retained indicators used in the SEM model.

Table A3 Retained indicators in the final SEM model (continued)

Construct and measurement item		*Mean*	*SD*	*Std. loading*	*SMC*
Supply chain agility					
SA11	Developing lean inventory management systems to reduce waste and storage costs.	4.52	0.508	0.695	0.484
SA14	Developing ERP systems that can automatically and rapidly adjust procurement and inventory management.	4.53	0.507	0.650	0.422
Flexible logistics					
FL03	Using real-time parcel tracking systems to reduce delays and improve delivery accuracy.	4.50	0.528	0.804	0.646
FL08	Using RFID and the internet of things (IoT) to track and manage product movement accurately.	4.53	0.519	0.801	0.641
FL09	Creating backup transport routes to handle unexpected events such as disasters or emergency delays.	4.56	0.505	0.772	0.597
FL10	Developing the ability to switch logistics providers quickly to address transport problems.	4.50	0.524	0.737	0.543
FL14	Developing just-in-time transport systems to reduce inventory holding costs.	4.56	0.517	0.710	0.504
Dynamic marketing channel performance					
DC01	Using artificial intelligence to analyse customer behaviour for real-time adjustments to marketing channels.	4.43	0.643	0.885	0.784
DC04	Using chatbots and automated response systems to communicate with customers across multiple channels.	4.43	0.631	0.864	0.747
DC07	Using data analytics to study the customer journey and improve marketing channel effectiveness.	4.43	0.614	0.836	0.699
DC08	Improving retargeting effectiveness by using artificial intelligence to analyse customer purchasing behaviour.	4.41	0.634	0.842	0.708
DC09	Using marketing automation to adjust channel-specific campaigns efficiently and in line with customer behaviour data.	4.40	0.624	0.849	0.721
DC10	Developing flexible marketing channels that can be rapidly adjusted to consumer trends.	4.45	0.613	0.834	0.696
DC11	Using personalised marketing to offer individual promotions or special offers to each customer.	4.44	0.582	0.843	0.710

Notes: Std. loading = standardised factor loading; SMC = squared multiple correlation. All retained indicators were statistically significant at $p < 0.001$. The mean and SD were calculated from the final set of retained indicators used in the SEM model.