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Examining the Effects of Digital Transformation on Market Development Among Tourism Enterprises in Vietnam's Northern Mountainous Region: An SEM-Based Analysis

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ABSTRACT

Digital transformation is essential for tourism enterprises in Vietnam's Northern Mountainous Region to overcome infrastructure and resource constraints. This study examines the impact of five digital transformation components, namely Digital Leadership and Culture (LC), Infrastructure and Technology (IT), Digital Operations and Processes (OP), Digital Customer Experience (CX), and Digital Skills (SK), on Market Development (MP). Using a quantitative approach, data were collected from 248 tourism businesses and analyzed through Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM). The results reveal that all five factors significantly and positively influence MP, with CX and SK exerting the strongest effects. These findings contribute to the Dynamic Capabilities theory by highlighting how digital integration enables small and medium-sized tourism enterprises (SMEs) in emerging markets to expand their reach. Practically, the study suggests that managers should prioritize "capacity bottlenecks" by investing in customer-centric digital tools and employee training to optimize market expansion in a competitive digital environment.

1. INTRODUCTION

The mountainous region of Northern Vietnam is a tourism area rich in natural and cultural resources, notable for its high mountain landscapes, climate varying with altitude, and diverse ethnic communities. Tourism in many mountainous areas plays a vital role in creating jobs, promoting livelihood shifts, and enhancing local incomes. However, development also increases pressure on resources, the environment, and social structures if appropriate governance is lacking. Therefore, a sustainable development approach and destination governance are considered crucial conditions for maintaining long-term growth [1, 2].

At the enterprise level, the mountainous context demands both leveraging the advantages of "nature-culture-experience" and overcoming common barriers such as small scale, limited market management capabilities, and difficulties in human resources. In this environment, digital transformation is expected to help businesses expand market access, optimize operations, and create new forms of competition based on data and digital platforms [3-5]. Recent studies highlight that digital transformation is not merely a single technology investment but a process of restructuring strategic organizational capabilities to create value in volatile environments [6, 7]. The roles of digital leadership, organizational learning, and continuous innovation are emphasized as key factors ensuring that digital transformation produces tangible market outcomes [1].

From practical implementation and research overview, the main gaps lie in three areas. First, quantitative evidence on the impact of digital transformation on Market Development (MP) at the enterprise level in mountainous tourism remains limited, especially where the "digital gap" in infrastructure and skills can significantly alter effectiveness. Second, there is a need for models that clearly separate digital transformation components into distinct capabilities rather than just measuring technology application levels [6]. Third, these components must be simultaneously tested to identify prominent impact factors and prioritize resources according to the "competency bottleneck" logic [8].

Therefore, this study proposes and tests a Structural Equation Modeling (SEM) model with MP as the dependent variable and five explanatory variables: Leadership and Digital Culture (LC), Infrastructure and Technology (IT), Operations and Digital Processes (OP), Digital Customer Experience (CX), and Digital Skills and Talent (SK). The research objectives are (i) to assess the reliability and validity of the digital transformation scales; (ii) to test the suitability of the measurement and structural models; and (iii) to determine the impact of LC, IT, OP, CX, and SK on MP to propose

management implications for prioritized investment. This provides empirical evidence for "investing in the right bottlenecks" to enhance MP capacity in a competitive digital environment.

2. LITERATURE REVIEW

Digital transformation is fundamentally considered a strategic process of restructuring organizational strategies and capabilities to create value through technology, data, and digital platforms [6, 9]. In this study, MP is defined as the capacity to grow and expand the market by enlarging the customer base and enhancing coverage across digital channels [7, 10]. From a dynamic capabilities perspective, digital transformation is not merely about adopting technology but about the continuous reconfiguration of resources to maintain a competitive advantage [1, 11]. Therefore, this study analyzes digital transformation through five components: LC, IT, OP, CX, and SK.

2.1 Leadership and Digital Culture

LC reflects the digital vision and leadership commitment that encourage innovation and data-driven decision-making [1]. Recent literature emphasizes that digital transformation is primarily an organizational challenge where leadership determines the success of converting technology into business value [6, 12]. In mountain tourism, a strong digital culture supports consistent digitalization and clear market orientation, directly boosting MP [1, 13].
H1: *LC positively impacts MP*.

2.2 Infrastructure and Technology

IT represents the readiness of digital platforms such as cloud systems and data to support operational integration [14]. Modern IT infrastructure acts as a prerequisite for organizational adaptation and scaling [15]. Contemporary research suggests that IT capabilities create the most value when integrated into marketing and market-access activities [9, 16]. For tourism businesses, robust infrastructure increases presence in the global digital environment, thereby facilitating MP [4, 15].
H2: *IT positively impacts MP*.

2.3 Operations and Digital Processes

OP reflects the degree of digitalization of internal processes to increase response speed and efficiency [17]. Modern Business Process Management ensures alignment between digital strategy and operational execution [18]. Digitalized operations help reduce service friction and improve reliability [19]. This operational agility is critical for tourism businesses to maintain quality standards as they scale their market reach [17, 19].
H3: *OP positively impacts MP*.

2.4 Digital Customer Experience

CX is the ability to manage touchpoints where online channels become the primary space for service discovery [20]. Recent research highlights that multi-channel experiences dominate traveler behavior and loyalty [21]. In mountain tourism, superior digital CX can increase conversion rates and amplify electronic word-of-mouth, significantly accelerating MP [20, 21].
H4: *CX positively impacts MP*.

2.5 Digital Skills and Talent

SK reflects the digital literacy of personnel and their ability to adapt to new technologies [16]. The effectiveness of digital tools depends entirely on human capabilities to activate their value [8]. In emerging mountainous regions, the digital skills gap is a primary bottleneck for tourism development [8, 13]. Strengthening digital skills enables employees to utilize data-driven service techniques effectively, leading to improved MP [8, 16].
H5: *SK positively impacts MP*.

3. PROPOSED RESEARCH AND HYPOTHESES

Based on theoretical overview, this study proposes a structural model to explain MP of tourism businesses in the northern mountainous region through five digital transformation components: LC, IT, OP, CX, and SK. The model assumes that each digital transformation component has a direct, positive impact on MP, contributing to improved market access, optimized sales channel efficiency, and enhanced customer service quality.

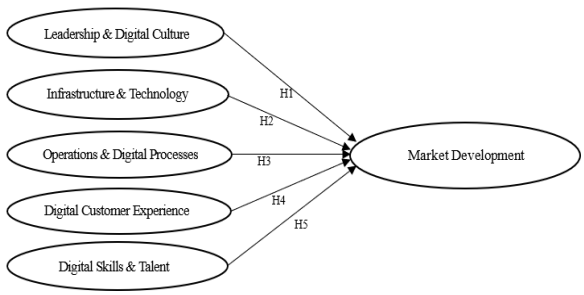

Figure 1. Proposed research model

Based on the proposed model presented in Figure 1, the study simultaneously tests the hypotheses: H1: LC → MP (+); H2: IT → MP (+); H3: OP → MP (+); H4: CX → MP (+); H5: SK → MP (+) using a flat SEM method with enterprise survey data. The estimation results will allow the identification of the level and components of digital transformation that have a prominent impact on MP, thereby providing managerial implications for prioritizing investments based on capacity "bottlenecks" to promote market expansion for businesses.

4. RESEARCH METHODOLOGY

4.1 Research design

This study uses a quantitative design and a cross-sectional survey to examine the impact of five digital transformation components, which include LC, IT, OP, CX, and SK, on MP. The hypothetical model was tested using planar SEM (CB-SEM) following a two-step process: (i) testing the measurement model (Confirmatory Factor Analysis (CFA)) and (ii) testing the structural model (SEM) [1, 6].

4.2 Sample and data collection

The analytical unit for this research is the tourism business. The target population consists of small and medium-sized tourism enterprises (SMEs) operating in the Northern Mountainous Region of Vietnam. The sampling frame was developed from business directories provided by the Departments of Culture, Sports, and Tourism in key provinces, such as Thai Nguyen, Lao Cai, and Ha Giang.

We employed a non-probability convenience sampling strategy combined with snowballing techniques through local tourism associations. This approach facilitated the identification of one representative respondent from each business, prioritizing owners, directors, or managers familiar with digital transformation activities. Data collection was conducted from August to November 2025 through an online questionnaire using Google Forms, combined with in-person interviews to increase response rates.

Regarding the response rate, a total of 350 survey invitations were distributed. We received 272 responses, and after a rigorous cleaning process, 24 responses were excluded due to incompleteness or inconsistent answer patterns. This resulted in a final sample of 248 valid responses, representing a 70.8% effective response rate. This sample size is considered appropriate for SEM analysis. Before performing the main analysis, the data were checked for missing values, outliers, and distribution abnormalities to ensure that all statistical requirements were met.

4.3 Measurement instrument

The measurement of research variables is described in Table 1. The concepts in the model are measured as reflective constructs using a multi-observed scale. The questionnaire structure includes LC, IT, OP, CX, and SK (4 observed variables each) and MP (3 observed variables). The scales are inherited and adapted to the context of mountain tourism businesses based on previous studies on leadership-digital culture, IT infrastructure/competence, process management, customer experience, and marketing-market development capabilities [14, 16-18, 20].

All factors were measured using multiple observation variables with a 5-level Likert scale (1 = Completely disagree; 5 = Completely agree). These scales have been verified in many previous studies, thereby ensuring content validity and reliability when applied in this study.

Table 1. Constructs, number of items, and sources of measurement

Factor/Code	Number of Items	Description	Sources of Measurement
Leadership and Digital Culture (LC)	4	The level of commitment from leadership and organizational culture supporting digital transformation (digital mindset, readiness for change, encouragement of innovation, internal coordination).	[1, 6]
Infrastructure and Technology (IT)	4	The readiness and flexibility of digital infrastructure and technology (IT systems, connectivity, data platforms) to support digital channel deployment and decision-making.	[14, 16]
Operations and Digital Processes (OP)	4	The level of digitalization/standardization of operational processes (automation, interoperability, control, efficiency optimization) supporting expansion of market service capacity.	[17, 18]
Digital Customer Experience (CX)	4	The level of customer/user experience management across digital touchpoints (multi-channel, convenience, responsiveness, consistent experience).	[20]
Digital Skills and Talent (SK)	4	The level of digital skills and training/recruitment policies for digital talent to deploy technology and improve services.	[8, 16]
Market Development (MP)	3	Market development results: increased customers, increased revenue, expansion of segments/regions/partnerships (matching MP1–MP3).	[10]

Source: Compiled by the authors based on prior studies

4.4 Data analysis methods

The research data were processed through several stages using R software with the lavaan package. First, we conducted data cleaning and examined the measurement scale's reliability. To address the potential for Common Method Bias (CMB) often found in self-reported surveys, we implemented procedural remedies such as ensuring respondent anonymity and providing clear instructions to minimize social desirability bias.

Furthermore, we planned a statistical diagnostic using Harman's single-factor test to verify the data's integrity before proceeding with more complex analyses. The main analysis followed a two-step approach including CFA to validate the measurement model and SEM to test the hypothesized relationships. We used the Maximum Likelihood Robust (MLR) estimator to handle potential non-normality and ensure the stability of the results.

4.5 Ethical considerations

The survey participants were fully informed about the research objectives and participated voluntarily. The study did not collect personally identifiable information; data was kept confidential, securely stored, and used only for academic purposes. The results are reported in aggregated form, ensuring adherence to ethical principles in social science research.

5. RESULTS

5.1 Preliminary analysis and descriptive statistics

CMB Test: Before analyzing the enterprise profiles and testing the hypotheses, we performed Harman's single-factor test to assess the presence of CMB. The exploratory factor analysis of all manifest variables revealed that the first factor accounted for 31.408% of the total variance. Since this value is well below the threshold of 50%, we conclude that CMB does not significantly influence the validity of the study's findings.

Tourism Enterprises' Profile: The survey sample covers a

diverse range of tourism-related businesses in the Northern Mountainous Region. Table 2 presents the detailed profile of the 248 participating enterprises, including their primary business activities and years of operation.

Table 2. Tourism enterprises' profile (n = 248)

Variable	Frequency	Percent (%)
Length of operation		
Less than 5 years	46	18.5
From 5 to 10 years	83	33.5
More than 10 years	119	48.0
Business sector		
Travel	64	25.81
Accommodation	141	56.85
Other service	43	17.34
Number of employees		
Fewer than 20	73	29.44
From 20 to 50	116	46.77
More than 50	59	23.79
Position of respondents		
Manager/deputy manager	152	61.29
Head of department	96	38.71

Source: Authors' computation (2025)

As can be seen from Table 2, the survey sample has a relatively diverse structure and is suitable for reflecting the characteristics of tourism businesses in the study area. Regarding operating time, the group of businesses operating for over 10 years accounts for the largest proportion (48.0%), followed by the 5-10 year group (33.5%) and under 5 years (18.5%), indicating that most businesses have a certain level of operational experience. In terms of business sector, accommodation businesses are dominant (56.85%), while travel agencies account for 25.81% and other services account for 17.34%, implying that the sample leans towards businesses providing accommodation services. Regarding workforce size, businesses with 20-50 employees account for the highest percentage (46.77%), followed by those with fewer than 20 (29.44%) and more than 50 (23.79%), reflecting the predominant small and medium-sized enterprise (SME) structure. Regarding respondent positions, the majority were managers/deputy managers (61.29%), while the remainder were department heads (38.71%), indicating relatively reliable information due to respondents holding managerial roles and possessing the ability to understand digital transformation activities and market outcomes of their businesses. Overall, this sample structure provides a favorable foundation for SEM analysis of the impact of digital transformation components on MP.

5.2 Descriptive analysis of constructs

The descriptive results presented in Table 3 show that the factors have relatively high average values (M ≈ 3.36-3.63), with IT being the highest (M = 3.63), followed by OP (3.53), MP (3.51) and SK (3.50); LC (3.39) and CX are the lowest (3.36), implying that digital experience and digital culture still have room for improvement. The dispersion is generally average (SD = 0.56–0.81), with OP (SD = 0.81) and CX (0.80) showing larger variability, reflecting the uneven level of implementation among businesses. In terms of correlation, all independent variables are positively correlated with MP and are significant at $p < .01$, with the strongest correlation being CX-MP (r = 0.475) and OP-MP (r = 0.468), indicating the prominent role of digital experience and process digitalization in MP. The correlations between the independent variables were low to moderate (highest OP-CX r = 0.432), generally not suggesting serious multicollinearity. LC, in particular, showed no significant correlation with CX and SK, suggesting that digital culture may not have directly translated into digital experience/skills in this sample and needs further testing in SEM.

Table 3. Descriptive statistics and correlation matrix

Factor	Mean (M)	Std. (SD)	LC	IT	OP	CX	SK	MP
LC	3.52	0.71	1					
IT	3.63	0.73	0.227*	1				
OP	3.53	0.81	0.187*	0.344*	1			
CX	3.36	0.80	0.079	0.264*	0.432*	1		
SK	3.50	0.74	0.116	0.195*	0.310*	0.375*	1	
MP	3.51	0.56	0.260*	0.388*	0.468*	0.475*	0.427*	1

Note: *p < 0.01.
Source: Compiled by the author

5.3 Reliability analysis

The detailed CFA results in Table 4 demonstrate robust indicator reliability, as all standardized factor loadings range from 0.713 to 0.900, significantly exceeding the 0.70 threshold. The standard errors (S.E.) are relatively small and consistent across items, while the critical ratios (C.R.) far exceed the 1.96 benchmark, confirming that all items are highly significant at the $p < 0.001$ level. Importantly, the model achieved an excellent fit without freeing any error covariances, which preserves the theoretical integrity of the constructs. These results provide strong evidence for convergent validity, indicating that each set of observed variables effectively represents its respective latent digital transformation component. Consequently, the measurement model is fully validated and provides a reliable foundation for the subsequent SEM analysis.

The reliability results in Table 5 show that all scales meet the requirements, with Cronbach's alpha ranging from 0.800 to 0.914, exceeding the acceptable threshold of 0.70, reflecting good internal consistency. The composite reliability (CR) of the factors is in the range of 0.800-0.914, all ≥ 0.70, confirming the high reliability of the scales in the CFA model. Regarding convergence, the AVE of all factors is ≥ 0.50 (ranging from 0.502 to 0.781), indicating that the observed variables explain the variance of the latent variable well. Among them, MP has the strongest reliability and convergence ($\alpha = 0.914$; CR = 0.914; AVE = 0.781), followed by CX (AVE = 0.664) and OP (AVE = 0.624). Overall, these results confirm that the scale simultaneously meets the reliability and convergent validity criteria, qualifying it for SEM testing.

Table 4. Detailed Confirmatory Factor Analysis (CFA) results

Construct	Item	Std. Loading	S.E.	C.R. (t-Value)	P-Value
CX	CX3	0.849	(ref)	(ref)	***
	CX4	0.865	0.059	56.788	***
	CX1	0.791	0.060	57.133	***
	CX2	0.749	0.059	56.866	***
SK	SK4	0.813	0.055	61.943	***
	SK3	0.809	(ref)	(ref)	***
	SK1	0.811	0.054	63.509	***
	SK2	0.719	0.063	59.356	***
OP	OP4	0.854	(ref)	(ref)	***
	OP1	0.735	0.061	53.205	***
	OP3	0.745	0.065	63.732	***
	OP2	0.819	0.056	60.368	***
IT	IT3	0.807	(ref)	(ref)	***
	IT4	0.736	0.057	61.284	***
	IT1	0.713	0.055	61.059	***
	IT2	0.810	0.054	70.513	***
LC	LC1	0.798	(ref)	(ref)	***
	LC4	0.782	0.056	67.697	***
	LC2	0.727	0.055	59.522	***
	LC3	0.727	0.052	63.764	***
MP	MP3	0.900	0.039	89.347	***
	MP1	0.795	(ref)	(ref)	***
	MP2	0.792	0.042	82.500	***

Source. Compiled by the author.

Note: (ref) indicates the reference indicator fixed to 1.0 in unstandardized estimates; S.E. = Standard Error; C.R. = Critical Ratio (t-value). All factor loadings are statistically significant at the *** $p < 0.001$ level. Standardized loadings reported are from the "Standardized Regression Weights" output in AMOS.

Table 5. Reliability and convergent validity

Factors	No. of Items	Cronbach's Alpha	CR	AVE
LC	4	0.800	0.800	0.502
IT	4	0.851	0.851	0.589
OP	4	0.866	0.869	0.624
CX	4	0.886	0.887	0.664
SK	4	0.864	0.868	0.622
MP	3	0.914	0.914	0.781

Note: CR = composite reliability; AVE = average variance extracted. Requirements are commonly considered met when CR ≥ .700 and AVE ≥ .500.

5.4 Discriminant validity

Table 6. Discriminant validity (HTMT)

	LC	IT	OP	CX	SK	MP
LC	-					
IT	0.278	-				
OP	0.225	0.399	-			
CX	0.094	0.304	0.494	-		
SK	0.140	0.225	0.358	0.428	-	
MP	0.305	0.442	0.527	0.528	0.480	-

Note: HTMT = heterotrait–monotrait ratio. All HTMT values are below .850, supporting discriminant validity.

The HTMT results in Table 6 show that all factor pairs are less than 0.85, thus ensuring the discriminant validity of the scale. The highest observed HTMT values were 0.528 (CX-MP) and 0.527 (OP-MP), still far from the 0.85 threshold, indicating related but non-overlapping concepts. The remaining pairs were at low to medium levels (e.g., IT-MP = 0.442; SK-MP = 0.480; IT-OP = 0.399), consistent with theoretical expectations regarding the relationship between digital transformation components. Notably, LC-CX = 0.094 and LC-SK = 0.140 are very low, implying that digital culture in this sample may operate relatively independently of digital experience and digital skills (further details need to be seen in SEM). Overall, the HTMT results confirm that the measurement model meets the discrimination requirements and is qualified to interpret the effect pathways in the structural model.

5.5 Confirmatory Factor Analysis

The results presented in Table 7 demonstrate that both the measurement model (CFA) and the structural model (SEM) achieve an excellent fit with the empirical data. For the CFA model, the CMIN/DF ratio is 1.079, which is well within the recommended range of less than 3.0, while the p-value of 0.202 indicates that the model successfully reproduces the observed covariance matrix. The incremental fit indices, including CFI (0.995) and TLI (0.994), significantly exceed the 0.95 threshold, reflecting high model parsimony. Furthermore, the absolute fit indices demonstrate high precision, as the RMSEA is 0.018 (well below the 0.06 limit) and the SRMR is 0.039.

Table 7. Model fit indices for Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM)

Fit Index	CFA	SEM	Recommended Threshold
CMIN/DF	1.079	1.092	-
df	215	217	-
p-value	0.202	0.167	> .050
CFI	0.995	0.994	> .950
TLI	0.994	0.993	> .950
RMSEA	0.018	0.019	< .060
SRMR	0.039	0.036	< .080

Note: Estimation = MLR; missing data handled using FIML. Recommended thresholds are commonly used guidelines and should be interpreted alongside theory and model complexity. Fit indices were primarily calculated using IBM SPSS Amos, with SRMR supplemented by R to ensure a comprehensive evaluation of model fit.

Similarly, the SEM structural model exhibits strong statistical robustness. The CMIN/DF for the structural model is 1.092, which remains well within acceptable limits. The CFI and TLI for the structural model are 0.994 and 0.993, respectively, confirming that the hypothesized relationships among the latent constructs are highly consistent with the gathered data. The RMSEA (0.019) and SRMR (0.036) for the SEM also meet the most stringent cutoff criteria. The high degree of consistency between the CFA and SEM fit indices confirms that the measurement model is stable and provides a reliable foundation for testing the structural paths and research hypotheses.

5.6 Structural model and hypotheses testing

The structural model results presented in Table 8 show that all five hypotheses H1-H5 are supported, as the impact curves from LC, IT, OP, CX, SK to MP are all statistically significant ($p < 0.05$). The strongest impact is CX → MP with $\beta = 0.249$; $p = 0.001$, implying that improving CX is the most important lever for driving MP. This is followed by SK → MP ($\beta = 0.236$; $p = 0.004$) and OP → MP ($\beta = 0.207$; $p = 0.008$), indicating that digital human resource capabilities and operational process digitization play a prominent role in market expansion. The IT → MP ratio also has a positive

impact (β = 0.194; p = 0.006), confirming that IT are fundamental conditions supporting the deployment of digital channels and improving customer access efficiency. The LC → MP ratio has the smallest coefficient but is still significant (β = 0.154; p = 0.013), suggesting that the impact of digital leadership and culture is "activating" and may mainly be through other deployment mechanisms. The model explains 48.8% of the variance of MP (R^2 = 0.488), indicating that digital transformation capacity has a fairly good explanatory power for MP results in the surveyed sample of businesses. Estimation using MLR and handling missing data using FIML strengthens the reliability of the estimates. In practical terms, the results suggest that businesses should prioritize investments in the order of impact: CX → SK → OP → IT → LC to maximize MP efficiency. Overall, the model provides clear empirical evidence that digital transformation, when implemented synchronously across multiple components, can drive growth and market expansion for tourism businesses in the northern mountainous region.

The robustness of the structural model is further validated by the bootstrap analysis with 5,000 resamples, as presented in Table 9. All 95% bias-corrected confidence intervals (BC CI) for the hypothesized paths do not include zero, providing strong empirical evidence for the statistical significance and stability of the estimated effects. Notably, the OP → MP path, previously considered a borderline case, demonstrates a robust significant impact with a confidence interval of [0.068, 0.347] and a bootstrap p-value of 0.004. The minimal bias reported across all parameters further indicates that the structural model possesses high predictive validity and is not overly sensitive to sample variations. These rigorous diagnostics ensure a consistent decision rule, confirming that OP exert a substantive and reliable influence on MP.

The SEM figure shows a structural model that is consistent with the hypothesis, where LC, IT, OP, CX, and SK simultaneously directly impact MP. The normalized path coefficients in the figure are all positive, reflecting that digital transformation in each component contributes to driving MP. The strongest impact is CX → MP (β = 0.249), indicating that improving the CX is the most important lever for market expansion. This is followed by SK → MP (β = 0.236) and OP → MP (β = 0.207), highlighting the role of personnel digital skills and operational process digitization in improving market access and service efficiency. The IT → MP (β = 0.194) has a significant impact, reinforcing the foundational role of IT, while the LC → MP (β = 0.154), though the smallest, still shows the "activating" influence from digital awareness/culture. The two-way curves between the independent variables represent the correlation between the components of digital transformation, consistent with the implementation reality where digital capabilities often develop simultaneously and support each other. Overall, the illustration clearly shows the measurement structure (observed variables) and the causal structure (impact curves), enhancing the persuasiveness of the SEM results.

Table 8. Structural path coefficients and hypothesis testing

Hypothesis	Relationship	β Coefficient	S.E.	P-Value	Conclusion
H1	LC → MP	0.154	0.087	0.013	Supported
H2	IT → MP	0.194	0.100	0.006	Supported
H3	OP → MP	0.207	0.109	0.008	Supported
H4	CX → MP	0.249	0.101	0.001	Supported
H5	SK → MP	0.236	0.116	0.004	Supported
		R^2 (MP) = 0.488			

Note: β coefficients are standardized estimates (std.all). Estimation = MLR; missing data handled using FIML. R^2 represents the proportion of variance explained in the endogenous latent construct MP.

Table 9. Bootstrap results for path coefficients (standardized)

Hypoth-esis	Path	Std. Beta (β)	Bootstrap Mean	S.E.	95% Confidence Interval (BC)	P-Value (Bootstrap)
H4	CX → MP	0.249	0.251	0.066	[0.120, 0.385]*	0.001
H5	SK → MP	0.236	0.221	0.072	[0.081, 0.364]*	0.002
H3	OP → MP	0.207	0.207	0.071	[0.068, 0.347]*	0.004
H2	IT → MP	0.194	0.190	0.070	[0.054, 0.328]*	0.006
H1	LC →MP	0.154	0.166	0.060	[0.048, 0.285]*	0.010

Note: 95% Confidence Intervals were estimated using the Bias-corrected (BC) percentile method with 5,000 bootstrap resamples.

6. DISCUSSION

The SEM analysis reveals that digital transformation, as a multidimensional strategic capability, significantly drives MP for tourism SMEs in the Northern Mountainous Region (R^2 = 0.488). These findings lend strong empirical support to the Dynamic Capabilities framework, suggesting that digital integration enables firms to sense and seize new market opportunities by reconfiguring their operational assets [1].

The results shown in Figure 2 indicate that CX exerts the strongest influence (β = 0.249). This result is consistent with the findings of Liu et al. [7], who argued that digital touchpoints are the primary value creators in post-pandemic tourism recovery. However, while Liu focused on listed firms, our study extends this logic to SMEs in remote mountainous areas. In such contexts, where physical accessibility is limited, digital platforms serve as a vital "virtual gateway," bridging the geographic gap more effectively than traditional marketing [6]. This confirms that for mountain tourism, CX is not just a service enhancement but a fundamental market-entry capability.

Equally critical is the role of SK (β = 0.236). This finding corroborates the research by Minor et al. [8] which highlighted that a "digital skills gap" is the most significant bottleneck for hospitality growth in the UK [8]. By comparing our results, it becomes evident that this human-capital dependency is a global phenomenon. In Northern Vietnam, where the digital divide is prominent, human expertise acts as the essential link

to "activate" technology. Unlike the study by Kahveci [15], which emphasized hardware investment, our results suggest that in resource-constrained environments, investing in people (SK) yields higher returns for market expansion than investing in infrastructure (IT) alone.

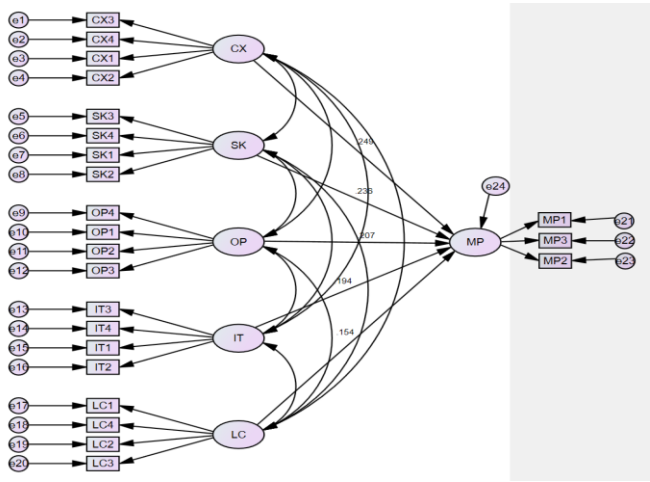

Figure 2. Structural Equation Model

Regarding OP (β = 0.207), our robust bootstrap results (5,000 resamples) provide a more stable conclusion than earlier studies that often found internal operations to have a "marginal" or "indirect" effect on market outcomes. Our findings contrast with Guo et al. [19], who suggested that internal digitalization primarily affects cost-saving rather than market reach. We argue that for tourism SMEs, digitized operations provide the "operational agility" required to maintain service quality while scaling up market presence.

In summary, the synergy between CX, SK, and OP demonstrates that digital transformation in mountain tourism follows a "Human-Experience-Process" triad. This integrated view provides a more comprehensive perspective than the technology-centric models found in earlier Smart Tourism literature [4], emphasizing that in emerging mountainous markets, the "soft" components of digital transformation (Experience and Skills) are the true engines of MP.

7. CONCLUSION AND IMPLICATIONS

7.1 Main conclusion

This study provides empirical evidence showing that digital transformation positively impacts MP of tourism businesses in the mountainous region of Northern Vietnam. The flat SEM model confirms that all five components LC, IT, OP, CX, and SK have a positive and statistically significant impact on MP. The model has good explanatory power with $R^2(MP) = 0.488$, indicating that the digital transformation components explain nearly half of the variation in MP in the survey sample.

7.2 Key results and priority implications

Considering the level of impact, the order of influence is CX (β = 0.249) > SK (β = 0.236) > OP (β = 0.207) > IT (β = 0.194) > LC (β = 0.154). This result implies that, in the context of small-scale, resource-limited, and "market-gap" tourism businesses in mountainous regions, digital capabilities directly linked to customer experience, digital human resources, and digital operations create a clearer market impact. Therefore, businesses should prioritize investment in the "bottlenecks" with the strongest impact first (CX, SK, OP), while simultaneously improving the platform (IT) and the guidance mechanism (LC) to ensure sustainable effectiveness.

7.3 Academic implications

Firstly, the study reinforces the view that digital transformation is a multidimensional structure, not synonymous with a single technology investment, but simultaneously encompassing governance-culture (LC), infrastructure (IT), processes (OP), experience (CX), and human resources (SK). Secondly, the results show that separating these components helps clarify the "mechanism" affecting MP, supporting the development of appropriate measurement and structural models for the tourism business context. Thirdly, the findings on the prominent roles of CX and SK suggest that the approach to digital transformation in tourism should focus on market touchpoints and implementation capabilities.

7.4 Management implications for businesses

1) CX: Prioritize improving the digital experience throughout the customer journey: standardize online information and content, simplify service booking procedures, increase response speed, and ensure a consistent multi-channel experience to increase conversion rates and online word-of-mouth.

2) SK: Develop a plan to enhance digital skills based on core competency groups (digital marketing, platform operation, basic data processing), combining short-term training with on-the-job learning incentives; and implement solutions to attract/retain digital talent that matches available resources.

3) OP: Digitize core processes (sales–service booking-service-after-sales care), standardize responsibilities and data, and reduce manual operations to increase productivity and ensure quality as the market size increases.

4) IT: Invest according to the principle of “sufficient use, flexible, easy integration”, prioritizing solutions that can be scaled and data interconnected; avoid scattered investments that cause waste.

5) LC: Strengthen leadership commitment, define digital transformation goals directly linked to MP, build data discipline and coordination mechanisms so that IT/OP/CX/SK investments are effective and stable.

7.5 Policy implications and industry support

The results suggest that regulatory agencies/associations should design support programs based on the “bottlenecks” of businesses in mountainous regions: (i) practical digital skills training by industry group (SK), (ii) toolkits/consulting packages for digitizing processes and experiences (OP, CX), (iii) support for shared platforms and infrastructure by destination cluster (IT), and (iv) consulting on change management and data governance standards for business owners (LC). A cluster-based approach will help reduce costs and increase the effectiveness of dissemination.

7.6 Limitations and future research directions

The study uses cross-sectional and self-reported data from

a single respondent/business, so it may be subject to general methodological bias; the sample size is concentrated in the northern mountainous region, so caution is needed when generalizing. Further studies could examine indirect impacts (e.g., LC → SK/OP/CX → MP), compare by business group (accommodation-travel), or add contextual variables (level of competition, destination location, level of local support) to enhance the explanatory power of MP.

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