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Dynamic Capabilities and Strategic Adaptation of Tourism MSMEs in the Bunaken Area: The Mediating Role of Digital Transformation

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Abstract

Tourism micro, small and medium enterprises (MSMEs) in Indonesia's priority tourism destinations face a widening gap between the digital expectations of travellers and their conventional business models. This study examines whether digital transformation mediates the relationship between dynamic capabilities and strategic adaptation among tourism MSMEs in the Bunaken area, North Sulawesi. An explanatory quantitative design was applied to data collected from 200 owners or managers of accommodation, culinary and tour service businesses selected through purposive sampling. Data were analysed using partial least squares structural equation modelling (PLS-SEM) with 5,000 bootstrap subsamples. The results show that dynamic capabilities positively influence digital transformation and strategic adaptation, while digital transformation positively influences strategic adaptation. Digital transformation significantly mediates the relationship between dynamic capabilities and strategic adaptation, with an indirect effect of $\beta = 0.242$ and complementary partial mediation, accounting for 52.3 per cent of the total effect. Descriptive findings reveal a persistent capability–implementation gap: dynamic capabilities are relatively stronger than digital transformation and strategic adaptation. Digital culture also exceeds technology adoption and business process change, suggesting that willingness to transform has developed faster than actual implementation. The findings indicate that digital transformation serves as a key mechanism through which managerial capabilities are translated into strategic adaptation. For tourism MSMEs in island destinations, digital training is therefore unlikely to generate substantial returns without improvements in basic infrastructure, particularly electricity reliability and affordable data access.

Keywords:
Dynamic capabilities; Digital transformation; Strategic adaptation; Tourism MSMEs; PLS-SEM.

1. INTRODUCTION

The global tourism sector is undergoing a paradigm shift towards a digital ecosystem that demands organisational agility. Traveller behaviour has migrated almost entirely to digital channels for destination discovery, price comparison, booking and post-visit evaluation, and this migration has redefined the terms on which tourism businesses compete. Tourism is accordingly characterised as a dynamic, volatile and time-sensitive industry in which agility and market intelligence are preconditions for creating value and sustaining competitive advantage (Stylos et al., 2021). For micro, small and medium enterprises (MSMEs), which dominate the supply side of most island destinations, the shift is consequential: firms that cannot be found, compared or booked online are progressively excluded from the value chain regardless of the quality of the experience they offer.

The Bunaken area of North Sulawesi, Indonesia, illustrates this tension sharply. As part of a nationally designated priority tourism destination, the area combines exceptional marine natural capital with a supply base of small accommodation providers, culinary businesses and dive or tour operators whose digital competitiveness remains low. The observable pattern is one of strategic drift: business models remain largely conventional while the market they serve has transformed. The gap between the internal capabilities of these firms and the dynamics of their business environment creates a tangible risk of economic marginalisation for local operators, particularly as external investment and larger corporate actors enter the Manado–Likupang–Bunaken corridor. The post-pandemic recovery reinforced the point that survival correlated less with capital endowment than with the speed at which a firm could reconfigure what it already had.

Dynamic capabilities theory offers the most established explanation of how firms adjust to environmental volatility. Introduced by Teece, Pisano and Shuen (1997) and elaborated in subsequent work, the framework decomposes adaptive capacity into three interrelated processes: sensing opportunities and threats, seizing them through resource commitment, and reconfiguring the asset base accordingly (Teece, 2007; Teece & Leih, 2016). A decade of subsequent research has consistently identified these capabilities as determinants of business resilience, and a recent systematic review confirms that the theory continues to grow in influence and diffusion across management sub-fields, even as questions of construct consistency remain (Gonzalez-Samaniego et al., 2023). Two limitations of this body of work motivate the present study.

First, the position of digital technology within the framework remains contested. One stream treats digital technology as a static resource that firms acquire, effectively an input to capability. A more recent stream treats digital transformation as a deep organisational process encompassing technology adoption, business process redesign and cultural change, which makes it an outcome of capability rather than a substitute for it (Vial, 2019; Verhoef et al., 2021). Whether digital transformation functions as an antecedent, a moderator or a mediating mechanism in the capability–adaptation relationship has not been settled empirically, particularly outside large-firm settings. Matarazzo et al. (2021) provide supporting evidence for the mediating interpretation among Italian SMEs, while Warner and Wäger (2019) argue for a recursive relationship in which digital transformation itself builds capability.

Second, the empirical base of dynamic capabilities research is drawn overwhelmingly from large firms in developed economies and urban settings with reliable infrastructure (Parida et al., 2019; Scuotto et al., 2016). Whether the theory travels to resource-constrained MSMEs operating in island and conservation areas, where physical and digital infrastructure is intermittent, is an open question with practical consequences. This gap is not confined to the dynamic capability's literature: a systematic review of technology adoption research using the UTAUT framework identified minimal empirical evidence from Southeast Asia and Eastern Indonesia in particular, alongside a predominance of qualitative designs over variance-based structural modelling (Danang et al., 2026). If the causal chain from capability to adaptation is interrupted at the implementation stage rather than at the capability-formation stage, then capacity-building interventions alone will not produce adaptation.

This study therefore addresses the following research problem: how do tourism MSMEs in the Bunaken area achieve strategic adaptation amid technological disruption, and what role does digital transformation play in converting managerial capability into adaptive action? Four hypotheses are proposed. H1: dynamic capabilities have a positive effect on strategic adaptation. H2: dynamic capabilities have a positive effect on digital transformation. H3: digital transformation has a positive effect on strategic adaptation. H4: digital transformation mediates the relationship between dynamic capabilities and strategic adaptation.

The objective is to build and test an empirical model explaining the transition of tourism MSMEs from traditional entities to digitally agile organisations. The study contributes in three ways. Theoretically, it extends dynamic capabilities research to island MSMEs with constrained infrastructure, a setting under-represented in the literature, and it positions digital transformation explicitly as a mediating mechanism rather than an antecedent or moderator. Methodologically, it uses partial least squares structural equation modelling to decompose indirect effects, in contrast to the simple linear regression that has dominated prior work in this region. Practically, it produces a diagnosis that distinguishes capability deficits from implementation barriers, which carries direct implications for how digitalisation support programmes for tourism MSMEs should be designed.

The remainder of the paper is organised as follows. The next section details the research design, sample, instrument and analytical procedure. The results and discussion section reports the measurement and structural models, the mediation analysis, dimension-level comparisons and a robustness check on alternative causal specifications, and interprets these findings against the existing literature. The conclusion summarises the contribution and outlines limitations and directions for further research.

2. RESEARCH METHOD

2.1. Research Design

This study applied a quantitative explanatory design to test hypothesised causal relationships among latent constructs. The design was selected because the research objective is to establish the direction and magnitude of effects within a mediation model, rather than to explore an unfamiliar phenomenon. The unit of analysis is

the individual firm, represented by its owner or manager. The research model and the four hypotheses are presented in Figure 1.

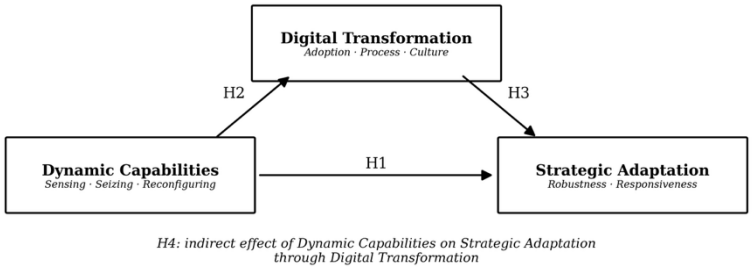

Figure 1. Research model

2.2. Population and Sample

The target population comprised tourism-sector MSMEs operating in the Bunaken area across three business categories: accommodation, culinary services and tour or dive services. Purposive sampling was used with two inclusion criteria: the business had been operating for at least two years, and the respondent was the owner or the person with managerial responsibility for business decisions. Two hundred valid responses were obtained. Use of social media in business operations was recorded as a descriptive characteristic rather than applied as an inclusion criterion, so that the sample would represent the full range of digital maturity in the destination, including firms at the earliest stage of digitalisation.

2.3. Instrument and Measurement

The instrument was developed from established scales and contextualised through a preliminary literature review and field observation in the Bunaken area. All items were measured on a five-point Likert scale ranging from strongly disagree to strongly agree. Dynamic capabilities were measured through the sensing, seizing and reconfiguring dimensions following Teece et al. (1997) and Teece (2007); digital transformation through technology adoption, business process change and digital culture following Vial (2019) and Verhoef et al. (2021); and strategic adaptation through business model robustness, drawing on the business model perspective of Teece (2018), and market responsiveness, adapted from the responsiveness component of market orientation developed by Jaworski and Kohli (1993) and contextualised for tourism by Stylos et al. (2021). Each dimension was represented by five items, except the two strategic adaptation dimensions, giving forty indicators in total. An open-ended question inviting respondents to describe the main obstacles to digitalisation in their business was appended to the questionnaire; responses were used only as supporting contextual evidence and were not modelled statistically. A pilot study involving thirty MSME operators was conducted before full data collection to verify the clarity, validity and reliability of the items.

Table 1. Construct operationalisation

Construct	Dimension	Items	Principal reference
Dynamic Capabilities	Sensing	X1–X5	Teece et al. (1997); Teece (2007)
	Seizing	X6–X10	Teece & Leih (2016)
	Reconfiguring	X11–X15	
Digital Transformation	Technology adoption	M1–M5	Vial (2019); Verhoef et al. (2021)
	Business process change	M6–M10	Matarazzo et al. (2021)
	Digital culture	M11–M15	
Strategic Adaptation	Business model robustness	Y1–Y5	Teece (2018)
	Market responsiveness	Y6–Y10	Jaworski & Kohli (1993); Stylos et al. (2021)

2.4. Data Collection Procedure

Data were collected through a combination of field surveys and an electronic questionnaire. Field enumeration was used for operators with limited connectivity, while the electronic instrument was offered to respondents who preferred it, improving efficiency without restricting participation to digitally active firms. Enumerators were briefed on the interpretation of each item to maintain consistency across administration modes.

2.5. Ethical Considerations

Participation was voluntary and based on informed consent. Respondents were advised of the purpose of the study and of their right to decline or withdraw. No personally identifying information was recorded, responses were analysed only in aggregate, and the data were used exclusively for academic purposes.

2.6. Data Analysis

Data were analysed using partial least squares structural equation modelling (PLS-SEM) in SmartPLS 4 (Ringle et al., 2024), with bootstrapping based on 5,000 subsamples and two-tailed testing at the 0.05 significance level. PLS-SEM was selected for three reasons: it accommodates complex models with mediating variables, it does not require multivariate normality, and it performs well with moderate sample sizes. The absence of normality in the present data was confirmed empirically, with Cramér–von Mises tests rejecting normality for all forty indicators ($p < 0.001$), supporting the choice of a variance-based rather than covariance-based estimator.

Analysis proceeded in two stages following Hair et al. (2022). The measurement model was assessed through outer loadings, Cronbach's alpha, composite reliability (rho_a and rho_c), average variance extracted, indicator collinearity, and discriminant validity using both the heterotrait–monotrait ratio (Henseler et al., 2015) and the Fornell–Larcker criterion (Fornell & Larcker, 1981). The structural model was then assessed through coefficients of determination, inner-model collinearity, path coefficients, effect sizes and bias-corrected bootstrap confidence intervals. Mediation was classified using the typology of Zhao et al. (2010), supplemented by the variance accounted for statistic. Two additional analyses were conducted: paired-sample comparisons of dimension scores to test whether observed descriptive differences were statistically meaningful, and a robustness check comparing alternative causal specifications of the structural model.

Dynamic capabilities were modelled as a single reflective construct with fifteen indicators spanning the three theoretical dimensions, rather than as a higher-order construct. This specification treats the three dimensions as a common domain of managerial capability and is consistent with the reflective nature of the items; its implications are addressed in the limitations.

3. RESULTS AND DISCUSSION

3.1. Respondent Profile

The profile of the 200 respondents is presented in Table 2. The sample is dominated by very small firms, with 55.5 per cent employing between one and four people and none employing more than nineteen. Business types are distributed across the three target categories, with a substantial proportion of respondents operating in more than one category, which reflects the diversified livelihood strategies typical of small island tourism economies. Notably, 38.0 per cent of respondents reported not using social media in their business, indicating that a substantial share of the destination's supply base remains at the earliest stage of digitalisation.

Table 2. Respondent characteristics (n = 200)

Characteristic	Category	Frequency	%
Business type	Accommodation	43	21.5
	Accommodation and culinary	31	15.5
	Tour services	31	15.5
	Accommodation and tour services	30	15.0
	Culinary	25	12.5
	Culinary and tour services	20	10.0
	All three categories	15	7.5
	No response	5	2.5
Years in operation	2–3 years	77	38.5
	4–5 years	68	34.0
	More than 5 years	53	26.5
	No response	2	1.0
Number of employees	1–4	111	55.5
	5–9	69	34.5
	10–19	20	10.0
Social media use	Yes	124	62.0
	No	76	38.0

3.2. Descriptive Statistics

Table 3 reports construct and dimension scores. The pattern is consistent and central to the interpretation that follows: dynamic capabilities score above the scale midpoint at 3.119, whereas digital transformation and strategic adaptation fall well below it at 2.474 and 2.454 respectively. Managerial capability in this population

is therefore not the scarcest element; its conversion into implemented digitalisation and observable adaptation is.

Table 3. Construct and dimension scores (n = 200)

Construct / dimension	Mean	SD
Dynamic Capabilities	3.119	0.814
Sensing	3.101	0.908
Seizing	3.129	0.876
Reconfiguring	3.128	0.848
Digital Transformation	2.474	0.726
Technology adoption	2.449	0.790
Business process change	2.440	0.811
Digital culture	2.533	0.778
Strategic Adaptation	2.454	0.649
Business model robustness	2.465	0.737
Market responsiveness	2.443	0.650

3.3. Measurement Model Assessment

All forty indicators loaded significantly on their assigned constructs at $p < 0.001$ (Table 4). Thirty-seven loadings exceeded the 0.708 threshold. Three indicators loaded below it (M2 = 0.646, M15 = 0.674, Y8 = 0.634) but were retained because every construct satisfied the average variance extracted and composite reliability criteria and because removal would have reduced content coverage without improving the model, in line with the guidance of Hair et al. (2022). Indicator collinearity was acceptable throughout, with outer variance inflation factors ranging from 1.515 to 3.586, all below the threshold of 5.

Table 4. Outer loadings and indicator significance

Indicator	Loading	t	Ind.	Loading	t	p
X1	0.796	26.897	M1	0.746	21.435	<0.001
X2	0.822	33.458	M2	0.646	9.874	<0.001
X3	0.816	34.353	M3	0.792	30.245	<0.001
X4	0.778	25.460	M4	0.750	21.672	<0.001
X5	0.835	38.752	M5	0.734	21.127	<0.001
X6	0.768	25.591	M6	0.766	26.702	<0.001
X7	0.770	23.879	M7	0.762	25.588	<0.001
X8	0.776	27.508	M8	0.775	25.529	<0.001
X9	0.844	40.864	M9	0.746	22.149	<0.001
X10	0.747	24.490	M10	0.791	27.564	<0.001
X11	0.780	26.958	M11	0.776	24.673	<0.001
X12	0.783	27.493	M12	0.765	25.200	<0.001
X13	0.750	22.886	M13	0.766	24.511	<0.001
X14	0.790	30.523	M14	0.722	19.463	<0.001
X15	0.774	30.016	M15	0.674	14.341	<0.001
Y1	0.729	19.270	Y6	0.733	22.499	<0.001
Y2	0.771	25.597	Y7	0.751	22.406	<0.001
Y3	0.708	17.054	Y8	0.634	14.724	<0.001
Y4	0.758	23.201	Y9	0.739	26.228	<0.001
Y5	0.805	27.840	Y10	0.776	24.563	<0.001

Note: X = Dynamic Capabilities; M = Digital Transformation; Y = Strategic Adaptation. All indicators significant at $p < 0.001$.

Reliability and convergent validity were satisfied for all three constructs (Table 5). Cronbach's alpha ranged from 0.909 to 0.957, composite reliability from 0.912 to 0.961, and average variance extracted from 0.550 to 0.623, exceeding the respective thresholds of 0.70, 0.70 and 0.50.

Table 5. Reliability and convergent validity

Construct	Cronbach's α	rho_a	rho_c	AVE
Strategic Adaptation	0.909	0.912	0.924	0.550
Dynamic Capabilities	0.957	0.958	0.961	0.623
Digital Transformation	0.944	0.945	0.950	0.560

Discriminant validity was confirmed by both criteria. All heterotrait–monotrait ratios fell below the conservative threshold of 0.85, the highest being 0.636 (Table 6), and the square root of each construct's average variance extracted exceeded its correlations with the other constructs (Table 7).

Table 6. Discriminant validity — heterotrait–monotrait ratio

Construct pair	HTMT	95% CI upper
Dynamic Capabilities ↔ Strategic Adaptation	0.488	0.594
Digital Transformation ↔ Strategic Adaptation	0.569	0.667
Digital Transformation ↔ Dynamic Capabilities	0.636	0.722

Table 7. Discriminant validity — Fornell–Larcker criterion

Construct	SA	DC	DT
Strategic Adaptation (SA)	0.742		
Dynamic Capabilities (DC)	0.463	0.789	
Digital Transformation (DT)	0.530	0.614	0.748

Note: diagonal values in bold type are the square roots of the average variance extracted; off-diagonal values are construct correlations.

Because all data were self-reported by a single respondent per firm at a single point in time, common method bias was assessed using the full collinearity approach of Kock (2015). The full collinearity variance inflation factors were 1.676 for dynamic capabilities, 1.831 for digital transformation and 1.451 for strategic adaptation, all comfortably below the 3.3 threshold, indicating that common method bias is unlikely to distort the estimates.

3.4. Structural Model and Hypothesis Testing

Dynamic capabilities explained 37.7 per cent of the variance in digital transformation, and the two exogenous constructs jointly explained 31.1 per cent of the variance in strategic adaptation (Table 8). Following Chin (1998), who classifies coefficients of determination of approximately 0.33 as moderate and 0.19 as weak, both values fall within the moderate range. Inner-model variance inflation factors of 1.000 and 1.605 confirm the absence of collinearity among predictors.

Table 8. Coefficients of determination and inner-model collinearity

Endogenous construct	R^2	Adjusted R^2	Inner VIF
Digital Transformation	0.377	0.374	1.000
Strategic Adaptation	0.311	0.304	1.605

All four hypotheses were supported (Table 9, illustrated in Figure 2). Dynamic capabilities exerted a positive and significant direct effect on strategic adaptation, although the effect size was small. The strongest path in the model ran from dynamic capabilities to digital transformation, with a large effect size. Digital transformation in turn affected strategic adaptation with an effect size approaching the medium category. The specific indirect effect was significant and its bias-corrected confidence interval excluded zero. The total effect of dynamic capabilities on strategic adaptation was 0.463, which decomposes into a direct component of 0.221 and an indirect component of 0.242.

Table 9. Hypothesis testing results

H	Path	β	SE	t	p	95% BCa CI	f^2	Result
H1	DC → SA (direct)	0.221	0.073	3.026	0.002	[0.068, 0.351]	0.044	Supported
H2	DC → DT	0.614	0.044	14.093	<0.001	[0.518, 0.691]	0.605	Supported
H3	DT → SA	0.394	0.067	5.904	<0.001	[0.258, 0.519]	0.141	Supported
H4	DC → DT → SA (indirect)	0.242	0.049	4.913	<0.001	[0.152, 0.340]	—	Supported
—	DC → SA (total)	0.463	0.052	8.974	<0.001	—	—	—

Note: DC = Dynamic Capabilities; DT = Digital Transformation; SA = Strategic Adaptation. SE denotes the bootstrap standard error. Confidence intervals are bias-corrected and accelerated, based on 5,000 subsamples, two-tailed at the 0.05 level. Effect sizes follow Cohen (1988): 0.02 small, 0.15 medium, 0.35 large.

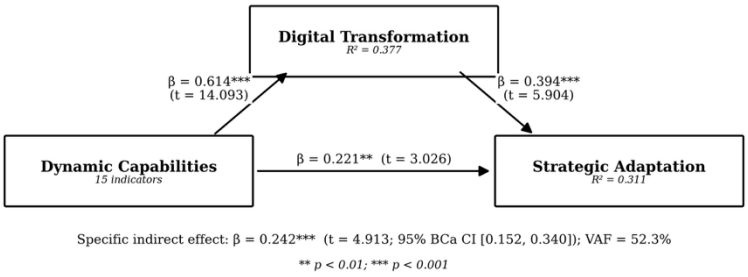

Figure 2. Structural model with path coefficients

For transparency, the original SmartPLS algorithm output is reproduced in Figure 3, showing the complete model with all forty indicators, their outer loadings, the path coefficients and the coefficients of determination as generated by the software. The construct labels appear in Indonesian, the language in which the model was estimated: Kapabilitas Dinamis denotes dynamic capabilities, Transformasi Digital denotes digital transformation, and Adaptasi Strategis denotes strategic adaptation.

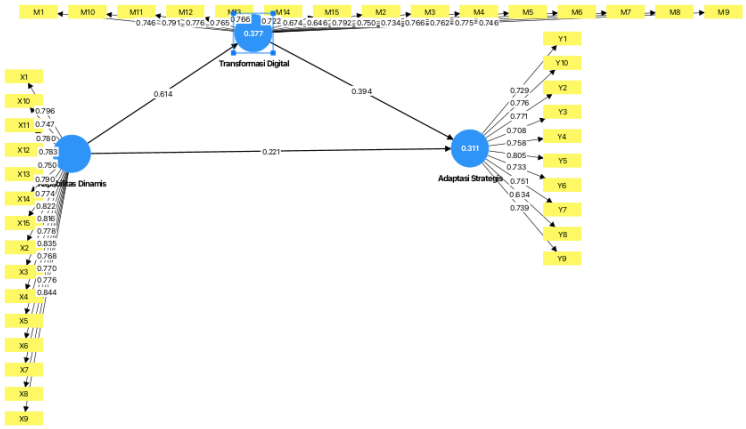

Figure 3. Original SmartPLS 4 algorithm output

Model fit was assessed using the standardised root mean square residual, which reached 0.061 for the estimated model and thus satisfies the conventional threshold of 0.08 for approximate fit. Because the structural model is saturated, this value reflects the measurement model rather than the specified causal ordering, and it should be read as an indication of approximate rather than exact fit.

3.5. Mediation Analysis

Both the direct effect (β = 0.221; p = 0.002) and the indirect effect through digital transformation (β = 0.242; p < 0.001) were significant and positive in sign. Following the typology of Zhao et al. (2010), this configuration constitutes complementary partial mediation. The variance accounted for statistic was 52.3 per cent, meaning that slightly more than half of the total effect of dynamic capabilities on strategic adaptation travels through digital transformation. The two routes are therefore of broadly comparable magnitude, with the mediated route marginally the larger of the two.

A comparable mediation pattern has been reported in the same regional setting. Tamau et al. (2026) found that supply chain transparency exerted no significant direct effect on green skepticism among specialty coffee consumers in Manado, and reduced it only by first building perceived brand authenticity, a case of full mediation in the terms of Zhao et al. (2010). The present study identifies complementary partial mediation rather than full mediation, but the underlying logic is consistent: in this regional context an antecedent construct tends to require an intermediate mechanism before it produces its intended outcome, and analyses restricted to direct relationships risk understating the antecedent's contribution.

This result provides a mechanistic account of the strategic drift observed in the field. Stagnation among tourism MSMEs is commonly attributed to deficient managerial capacity. The present findings suggest a different reading: managerial capability among Bunaken operators is moderate rather than absent, but a substantial part of it does not convert into adaptation because the conversion channel, digital transformation, is functioning imperfectly. Digitalisation is thus not a supplementary element of strategy but a principal mechanism translating managerial capacity into measurable adaptive action.

3.6. Dimension-Level Comparisons

Because the descriptive scores in Table 3 differ only slightly across dimensions, paired-sample tests were conducted to establish which differences are statistically meaningful (Table 10). Within dynamic capabilities, none of the three dimensions differed significantly from the others; sensing, seizing and reconfiguring are effectively at parity. Within strategic adaptation, business model robustness and market responsiveness likewise did not differ significantly. Within digital transformation, however, digital culture scored significantly higher than both technology adoption and business process change, while the latter two did not differ from each other. The effect sizes for these two significant contrasts are small.

Table 10. Paired-sample comparisons of dimension scores (n = 200)

Comparison	Difference	t	p	Wilcoxon p	Cohen's d
Seizing vs sensing	+0.028	0.71	0.481	0.652	0.050
Reconfiguring vs sensing	+0.027	0.70	0.487	0.435	0.049
Seizing vs reconfiguring	+0.001	0.02	0.981	0.911	0.002
Digital culture vs technology adoption	+0.084	2.27	0.024	0.005	0.160
Digital culture vs process change	+0.093	2.26	0.025	0.029	0.160
Technology adoption vs process change	+0.009	0.23	0.819	0.973	0.016
Business model robustness vs market responsiveness	+0.022	0.63	0.532	0.553	0.044

The single robust dimension-level finding is therefore that digital culture, understood as openness and willingness to work digitally, runs ahead of both the technology actually adopted and the business processes actually redesigned. Willingness precedes practice. This pattern locates the constraint at implementation rather than at attitude, and it is reinforced by the open-ended responses, in which participants repeatedly cited rotating power outages disrupting operations and limited supporting facilities, including difficulty for visitors in completing financial transactions. Consistent with this, respondents not using social media recorded a lower digital transformation score (2.272) than those using it (2.598).

3.7. Robustness Check: Alternative Causal Specifications

The structural model contains three constructs and three paths and is therefore saturated, with zero degrees of freedom at the structural level. A saturated model reproduces the construct correlation matrix exactly regardless of the causal ordering imposed, which means that fit statistics cannot adjudicate between alternative orderings. To make this limitation explicit rather than leave it implicit, two alternative specifications were estimated from the same latent variable correlations (Table 11).

Table 11. Comparison of alternative causal specifications

Specification	Direct	Indirect	Total	VAF	R^2 SA
DC → DT → SA (hypothesised)	0.221	0.242	0.463	52.3%	0.311
DT → DC → SA (reversed)	0.394	0.135	0.530	25.6%	0.311
DC → SA → DT	0.463	0.145	0.614	23.5%	0.311

All three specifications yield identical fit and identical explained variance in strategic adaptation, and all paths remain significant in each. The selection of the hypothesised ordering therefore rests on theoretical and contextual grounds rather than on statistical evidence. Three arguments support it. First, dynamic capabilities are conceptualised as higher-order managerial capacities that logically precede the decisions and implementation efforts constituting digital transformation (Teece, 2007). Second, the leading process-based accounts of digital transformation describe it as an organisational change effort that must be enacted by some prior capacity rather than acquired as a discrete asset (Vial, 2019; Verhoef et al., 2021), and Matarazzo et al. (2021) model precisely this ordering in an SME setting. Third, the descriptive pattern in this sample is difficult to reconcile with the reverse ordering: dynamic capabilities score 3.119 while digital transformation reaches only 2.474, so it is implausible that the lower-scoring construct generated the higher-scoring one. The recursive perspective advanced by Warner and Wäger (2019), in which digital transformation also builds capability over time, remains plausible and can only be tested with longitudinal data.

3.8. Discussion

The support for H1 confirms that dynamic capabilities contribute directly to strategic adaptation, but the small effect size qualifies the mainstream proposition of Teece and Leih (2016), which positions dynamic capabilities as the principal determinant of business resilience. That proposition was largely tested on larger firms possessing the organisational structure, resources and infrastructure access required to execute strategic decisions autonomously. In the island MSME context those conditions do not hold. Dynamic capabilities here appear necessary but not sufficient: a prerequisite for adaptation rather than its sole determinant. This reading is consistent with the qualification advanced by Eisenhardt and Martin (2000), who argued that dynamic

capabilities are necessary but not sufficient for competitive advantage because their value resides in the resource configurations they produce rather than in the capabilities themselves. Where the means of reconfiguration are constrained, as they are in an island destination with intermittent infrastructure, the capability may be present while its output remains limited.

The support for H2, the strongest path in the model, indicates that MSME digitalisation is not primarily a technology purchasing decision but an organisational manifestation of the capacity to detect opportunities, commit to them and reconfigure resources accordingly. This aligns with Vial (2019) and Verhoef et al. (2021), who treat digital transformation as a deep organisational process rather than a static asset, and it corroborates Matarazzo et al. (2021) in the Italian SME setting. The long-running debate over the position of digital technology within the dynamic capabilities framework thus receives empirical support on the side that regards digitalisation as a process.

The support for H3 confirms that digital transformation strengthens business model robustness and market responsiveness, consistent with the argument of Stylos et al. (2021) that data-enabled capability underpins agility in tourism organisations. The magnitude of this path, however, is bounded by the depth at which technology is used. Both strategic adaptation dimensions score below the scale midpoint and do not differ significantly from one another, indicating that adaptation is uniformly limited rather than advanced on one front and lagging on another. Taken together with the low scores for technology adoption and process change, this suggests that digital tools in the destination are being used for reach rather than for decision-making: to be visible to travellers rather than to read customer data, adjust pricing or redesign service packages.

The most distinctive contribution emerges from combining the mediation result with the descriptive pattern. Capability outruns implementation by a wide margin, and within digital transformation the only statistically robust dimension-level difference is that culture outruns both technology and process. The barrier to digitalisation among Bunaken tourism MSMEs is therefore structural and infrastructural rather than cognitive or cultural. This is the contextual contribution of the study to a literature dominated by urban settings in developed economies (Parida et al., 2019; Scuotto et al., 2016): in island conservation areas with intermittent infrastructure, the causal chain from capability to adaptation is obstructed at the technology implementation stage, not at the capability formation stage.

Theoretically, the study makes three contributions. It extends dynamic capabilities theory to MSMEs in island regions with infrastructure constraints, a setting that has been under-represented. It positions digital transformation explicitly as a mediating variable rather than an antecedent or a moderator, and it tests that position empirically while acknowledging that the ordering itself is theoretically rather than statistically determined. And it shows that a mediated specification yields a more informative account than a direct-effect specification: the total effect of 0.463 decomposes into a direct component of 0.221 and an indirect component of 0.242, so an analysis restricted to the direct relationship would attribute to managerial capability an influence that in fact operates through technology.

For MSME operators, the findings recommend shifting the focus of digitalisation from promotion towards process, encompassing reservation systems, transaction records and inventory management. Process change is both the lowest-scoring area within digital transformation and the one with the clearest scope for improving strategic adaptation. In practice, this shift is best sequenced rather than attempted at once. Recording daily transactions digitally, using a simple digital ledger or point-of-sale application in place of a paper notebook, presents the lowest barrier to entry and yields an immediate operational benefit independent of visitor-side connectivity, making it a reasonable starting point. Digital booking and reservation management can then be layered onto the messaging channels operators already use for customer contact, which avoids the cost and learning curve of dedicated booking software, while basic digital inventory tracking can be linked to the same transaction record so that stock and sales data are captured jointly rather than as separate tasks. Because the evidence indicates that willingness to adopt these practices is already present, delivery is likely to be more effective through sustained peer mentoring within existing local business or tourism-awareness groups than through one-off workshops, which build awareness but not habitual use.

For the regional tourism authority and the managers of Bunaken National Park, the central implication is that digital training programmes will not achieve their intended effect unless accompanied by improvements to basic infrastructure, particularly the reliability of electricity supply and the affordability of data access for micro-enterprises. Concretely, this implies sequencing rather than parallel delivery: infrastructure upgrades and data-cost interventions, such as negotiated bulk data packages or shared community connectivity points, should precede or accompany training cohorts rather than follow them, and rollout should be prioritised for the functions this study identifies as weakest, namely transaction recording and process digitalisation, rather than for the promotional and social media skills that operators already use comparatively well. Partnership arrangements involving the tourism authority, telecommunication providers and existing cooperative structures may offer a more tractable route to affordable connectivity for individual micro-enterprises than expecting operators to secure it independently. The evidence indicates that the willingness of operators to transform is already present; what is absent is the physical precondition for realising it. This recommendation forms the substance of the policy brief produced by the study and supports Sustainable Development Goals 8 and 9.

4. CONCLUSION

This study set out to determine how tourism MSMEs in the Bunaken area achieve strategic adaptation amid technological disruption, and specifically whether digital transformation mediates the relationship between dynamic capabilities and strategic adaptation. Using PLS-SEM on responses from 200 owners and managers, all four hypotheses were supported. Dynamic capabilities affected strategic adaptation directly, though with a small effect size, and affected digital transformation strongly. Digital transformation in turn affected strategic adaptation. The mediating effect was significant and complementary in form, channelling 52.3 per cent of the total effect.

The principal finding is not the mediation itself but the gap it reveals. Dynamic capabilities scored above the scale midpoint while digital transformation and strategic adaptation scored well below it, and paired testing established that digital culture significantly exceeds both technology adoption and process change. Capability and willingness are present; implementation is not. The constraint in this destination is structural rather than cognitive, and the causal chain from capability to adaptation is interrupted at the point of technology implementation.

The study contributes to dynamic capabilities theory by extending it to island MSMEs with constrained infrastructure and by specifying and testing digital transformation as a mediating mechanism. For practice, it recommends redirecting MSME digitalisation from promotional applications towards process digitalisation, and it recommends that digital capacity-building programmes be sequenced with, or conditional upon, improvements to electricity reliability and data affordability.

Five limitations qualify these conclusions. First, the model explains 31.1 per cent of the variance in strategic adaptation, leaving 68.9 per cent attributable to factors outside it, such as access to capital, institutional support and infrastructure quality; subsequent work should incorporate these, with digital infrastructure a strong candidate for a moderating role. Second, the cross-sectional design precludes conclusions about temporal causality, and as the robustness check demonstrates, alternative causal orderings cannot be ruled out empirically in a saturated structural model; longitudinal designs are required. Third, dynamic capabilities were modelled as a single reflective construct rather than as a higher-order construct, so the relative contribution of sensing, seizing and reconfiguring was not estimated; a disjoint two-stage higher-order specification would address this. Fourth, predictive relevance was not assessed through blindfolding or PLSpredict, which should be included in future replications. Fifth, the study covers a single destination, so its generalisability to other marine tourism destinations remains to be established.

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