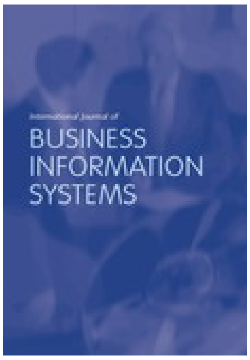

International Journal of Business Information Systems

ISSN online: 1746-0980 - ISSN print: 1746-0972
https://www.inderscience.com/ijbis

Digital and managerial capabilities, resilience, and innovation for the sustainability of traditional cosmetic businesses in China

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DOI: 10.1504/IJBIS.2026.10079060

Article History:

Received:	10 December 2025
Last revised:	20 May 2026
Accepted:	20 May 2026
Published online:	30 June 2026

Digital and managerial capabilities, resilience, and innovation for the sustainability of traditional cosmetic businesses in China

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Abstract: This study examines how resilience and innovation capability mediate how mobile marketing, AI, and future managerial competencies improve the sustainability of traditional Chinese cosmetic businesses. Structured surveys were used to obtain data from 424 Guangdong traditional cosmetic retailers. Confirmatory factor analysis confirmed reliability and validity, then covariance-based structural equation modelling and bootstrapped confidence intervals based on 1,500 re-samples assessed structural links and mediation effects. The results suggest that all three talents boost organisational resilience. Resilience improves sustainability directly and indirectly through innovation, demonstrating a sequential mediation mechanism. These findings support the resource-based view and dynamic capabilities theory by showing that resilience and innovation help small enterprises turn digital and managerial resources into long-term competitive sustainability. To improve resilience and innovation, business owners should invest in mobile marketing, accessible AI, and digital leadership development. Future study should widen the geographic reach and use longitudinal approaches due to regional and cross-sectional limitations.

Keywords: mobile marketing capability; MMC; artificial intelligence competency; organisational resilience; innovation capability; sustainable performance; cosmetic retail SMEs; China.

Reference to this paper should be made as follows: Wang, J. and Rattanapun, S. (2026) ‘Digital and managerial capabilities, resilience, and innovation for the sustainability of traditional cosmetic businesses in China’, *Int. J. Business Information Systems*, Vol. 52, No. 5, pp.1–20.

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1 Introduction

The latest digital transformation studies show how SMEs are increasingly depending on AI-based management skills. While China's cosmetic retail market will reach 1.4 trillion yuan by 2028, brick-and-mortar enterprises are dying (Statista, 2024). As 45% of China's cosmetic production is produced in this province, traditional cosmetic merchants face digital-native competition, regulatory restrictions, and consumers' mobile, social, and digital-platform journeys. In Guangdong Province, which produces 45% of China's cosmetics, traditional cosmetic retailers face digital-native competition, regulatory restrictions, and mobile, social, and digital-platform-oriented consumer journeys. Furthermore, the dynamic regulatory environment in the Chinese cosmetic market is driving SMEs to further improve digital traceability, quality management and operational governance systems to meet regulations and stay competitive (National Medical Products Administration, 2024).

Digital transformation, business information systems, and AI help SMEs compete and adapt in the changing business landscape (Verhoef et al., 2021; Dwivedi et al., 2023). Digital ecosystems, information systems integration, and digital transformation capability increase SMEs' adaptability, innovation, and strategic responsiveness in digitally transforming markets, according to other recent publications. Business information system capabilities and AI analytics are becoming more important to improve SMEs' responsiveness, efficiency, and strategic decision-making throughout digital transformation (Phan and Teoh, 2024). Digital proficiency and managerial capability are now more important than ever to ensure resilience and performance.

The latest research also finds that resiliency, innovativeness and sustainability in competitive retail markets is essential for SMEs to embrace digital transformation powered by AI. Research indicates that AIO, IS, and DIS SMEs are more adaptive and strategic in times of market volatility (Kahveci, 2025; Ragmoun, 2026). The digital ecosystem and integrated corporate information system have also been shown in recent research to promote the agility, innovation and competitiveness of SMEs in digital transformation. There are many different ways in which artificial intelligence (AI) and digital decision-making systems can help firms stay resilient in the face of adversity and ensure their performance (Dwivedi et al., 2023; Alshurideh et al., 2021).

Despite the increasing ubiquity of digital technologies, traditional retail SMEs are not yet using their digital and managerial skills to achieve long-term economic success. As customers become more mobile, this trend is leading large companies to pay more attention to mobile marketing systems, AI-driven analytics, and integrated digital platforms for better customer engagement and operations (Shankar et al., 2016; Huang and Rust, 2021). Budget, technological readiness and strategic agility are key challenges that many SMEs face in adapting to digital disruption. The traditional retail stores are facing very challenging and uncertain times.

Organisational resilience-the ability to absorb shocks, adapt to disruption, and reorganise resources for growth – is crucial to SME survival and competitiveness (Lengnick-Hall et al., 2011). There is little research on how traditional SMEs turn digital and managerial inputs into resilience, innovation, and sustainable performance. Digital transformation, resilience, and innovation are generally studied separately, but their sequential and interrelated nature in traditional retail is neglected.

Given this limitation, this work develops and tests an integrated model based on the resource-based view (RBV) (Barney, 1991) and dynamic capabilities theory (DCT) (Teece et al., 1997). This study views resilience and innovation capability (IC) as dynamic capabilities that turn foundational resources like mobile marketing capability (MMC), AI competency (AIC), and future managerial capability (FMC) into sustainable competitive outcomes. Specifically, this study seeks:

1 Discuss how MMC, AIC and FMC contribute to resilience.

2 Discuss the effects of resilience and IC on sustainability.

3 Test the sequential mediating roles of resilience and IC.

This study has three important implications. An empirically supported model illustrates the successive resilience and innovation mechanisms by which digital and managerial competencies enable sustained transformation. First, it uses an empirical model to describe how resilience and innovation capabilities enable sustainable change through digital and managerial skills. Second, it connects RBV and DCT theoretically to demonstrate how strategic resources support organisational adaptability and sustainability. Third, SME managers and policymakers can use the findings to improve resilience, creativity, and competitiveness in digitally altered retail settings.

2 Literature review and hypothesis development

2.1 Theoretical foundation and conceptual model

This research is anchored in the integration of the RBV and DCT. RBV posits that competitive advantage stems from valuable, rare, inimitable, and non-substitutable (VRIN) resources (Barney, 1991). We conceptualise MMC, AIC, and FMC as such strategic resources for traditional retailers. DCT complements RBV by explaining how firms systematically orchestrate and reconfigure resources to adapt to rapidly changing environments (Teece et al., 1997). We argue that resilience (RES) and IC represent higher-order dynamic capabilities that perform this orchestration function.

Our conceptual model synthesises these perspectives: digital and managerial resources (VRIN inputs) are leveraged through the dynamic capabilities of resilience and innovation to achieve the ultimate outcome of sustainability (SUS).

2.2 Hypothesis development

2.2.1 Digital/managerial capabilities and resilience

Mobile marketing lets organisations stay in touch with customers, customise campaigns, and respond swiftly to changing customer needs. Mobile engagement is extremely important for traditional cosmetic retail SMEs since consumers are increasingly using mobile stores, social commerce, and digital channels to research and buy products. Mobile marketing can sense the market, retain clients, and enhance operational flexibility during disruptions (Shankar et al., 2016; Verhoef et al., 2021). Recent SME digital transformation research found that competitiveness depends on technology adoption, digital tool integration into business processes and systems, customer interactions, and continuous improvement methods (Kahveci, 2025). Mobile marketing helps organisations stabilise demand, sustain client relationships, and adjust quickly to environmental risks.

AI competencies improve organisational resilience, data-driven decision-making, demand forecasting, customer behaviour analysis, and operational automation. AI-powered systems can analyse massive amounts of customer and market data and provide actionable insights that help retail businesses navigate market fluctuations, optimise stock levels, and adapt to changing customer preferences, trends, and needs. Research shows that AI can improve SME resilience by improving sensing, learning, creativity, and adaptive decision-making (Ragmoun, 2026; Davenport and Ronanki, 2018). Digital transformation requires adapting technology, evolving business models, collaborating and governing, and connecting with customers (Albino et al., 2023), and business intelligence capabilities are linked to information systems success and firm performance in uncertain business settings (Phan and Teoh, 2024). AIC, a digital strategy capacity, helps businesses improve flexibility, continuity, and resilience.

Future management competency is needed since digital technologies alone do not produce resilience. Managers must be able to analyse information, utilise resources, and manage change. Future managers need digital literacy, strategic foresight, adaptable leadership, and evidence-based decision making. These skills help companies identify opportunities and hazards, manage assets, and restructure operations during uncertainty (Teece, 2018; Qi and Rattanapun, 2024). Dynamic managerial capability detects environmental changes, captures digital possibilities, and reconfigures resources to deliver effective organisational responses. Future managerial competency (FMC) enhances mobile marketing and AI in resource coordination.

From the RBV, mobile marketing, AI, and future managerial skills are strategic resources. DCT suggests mobilising, integrating, and reconfiguring these resources to adapt to environmental turbulence (Barney, 1991; Teece, 2018). The transformation of digital and administrative resources into sustainable competitive responses is a crucial strategy for organisational resilience. Thus, organisations with stronger mobile marketing, AI, and future management skills may anticipate interruption, maintain operations, and effectively shift resources. Thus, the following possibilities are proposed.

H1 MMC positively influences resilience (RES).

H2 AIC positively influences resilience (RES).

H3 FMC positively influences resilience (RES).

2.2.2 Resilience, innovation, and sustainability

Resilient companies can make decisions under uncertainty and environmental disruptions, have resource flexibility, and learn (Linnenluecke, 2017; Duchek, 2020). Resilience enables organisations to survive storms, realign resources, try things out and learn, and in the process develop organisational innovation (Hamel and Välikangas, 2003). SMEs see resilience as a strategic dynamic capability which enhances adaptability, responsiveness and future competitiveness.

Organisational adaptability is nurtured to become sustained business performance by innovation. HICs are more likely to be innovative, re-engineer the business process, enhance consumer interaction and optimise the operation (Tidd and Bessant, 2021). Digital platforms, organisational processes, corporate info systems and social commerce technologies improve innovation through the means of communication and collaboration, integration of knowledge, etc. (Chatterjee and Kar, 2020). There is previous research that reveals the importance of innovation skill to gain competitive advantage and long term organisational performance by digital resources and technology (Nambisan et al., 2019; Verhoef et al., 2021).

New research shows that digital transformation, innovation capacity and flexible organisational processes are increasingly influencing the sustainability outcomes of SMEs (George et al., 2021; Kraus et al., 2021). Business information systems are essential for data-driven decision making, interaction with the customer, operational coordination, and strategic response, which ensures the continued performance of business (DeLone and McLean, 2003; Bharadwaj et al., 2013). As this is demonstrated in new IJBIS literature, digital business skills and information system integration can lead to a renewal, resilience and sustainability of an organisation in the face of change.

Resilience in dynamic capabilities is the capacity to absorb a shock, re-align internal resources and maintain operations in uncertain circumstances. This flexibility fosters innovation by learning, experimenting and changing organisational strategies. Innovation aptitude is what makes adaptive answers a competitive advantage in the delivery of better products, services and processes. Resilience has impacts on sustainability through business continuity, organisational stability and innovation potential (Lengnick-Hall et al., 2011). This connection is particularly important for traditional cosmetic retail SME to navigate digital disruption, consumer trends and digital-born rivals. The following hypotheses are made:

H4 Resilience (RES) positively influences IC.

H5 IC positively influences sustainability (SUS).

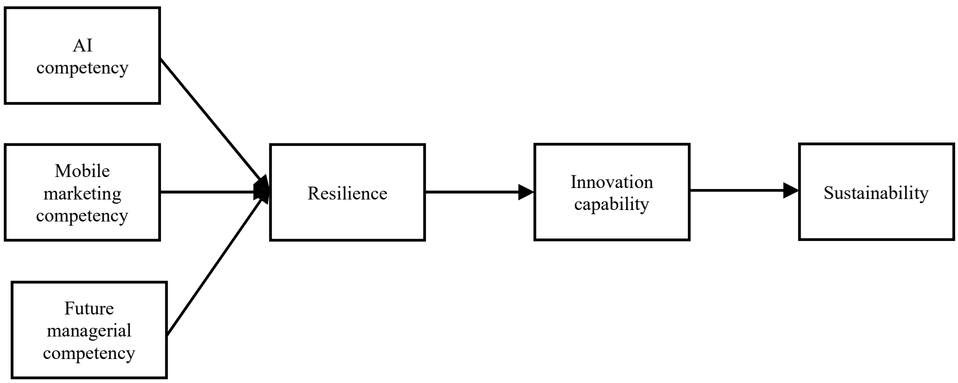
H6 Resilience (RES) positively influences sustainability (SUS).

2.2.3 The mediating pathways

The RBV holds that a firm's competitive advantage is derived from strategic resources and DCT states that these resources must be converted to adaptive and sustainable outcomes in a turbulent environment. Digital and managerial skills have no direct value in a digitally transformed SME context, but they are valued in the processes of the organisation to adapt, learn, be resilient and innovate. The capacity for resilience and innovation are dynamism traits that can convert technological and managerial resources into sustainable organisations in the long term.

Resilience helps organisations endure shocks, sustain operations, and reorganise resources during uncertainty (Duchek, 2020). As AI, environmental sensing, strategic responsiveness, customer engagement, and data-driven decision-making improve, firms that are better prepared for the mobile marketing landscape and have managers with future competency are more likely to develop adaptive resilience. Recent studies suggest that digital integration capacity, business intelligence use, and information systems flexibility boost SMEs' agility and strategic responsiveness. In resilience, corporate information systems help companies use operational data, align resources, and respond to environmental changes (Tarhini et al., 2021). Resilience can also help firms transform their technology and leadership capabilities into innovation-oriented organisational behaviours including flexibility, experimentation, and continuing learning (Warner and Wäger, 2019; Dubey et al., 2021).

Figure 1 Conceptual framework



Innovation to achieve sustainable goals is then driven by resilient adaptation. Innovation can help firms restructure their business models, streamline resource consumption, improve operational efficiency, and create long-term consumer value (Pisano, 2015; Tidd and Bessant, 2021). Recent digital transformation studies emphasise the necessity of innovation aptitude to turn digital resources and organisational adaptability into sustainable competitive performance in SMEs (George et al., 2021; Verhoef et al., 2021). Emerging business information system research shows that the digital ecosystem, AI-based process, and integrated information management system improve organisational agility, customer responsiveness, and strategic decision making, promoting organisational renewal and long-term sustainability (Kraus et al., 2021; Ciampi et al., 2022). *IJBIS* studies show that creating digital capabilities and integrating information systems are crucial for strategic renewal, innovative performance, and sustained business transformation in uncertain business contexts.

Research has linked digital capability, resilience, innovation, and sustainability, but little is known about how resilience and IC sequentially mediate the relationship between digital and managerial resources and sustainability outcomes in traditional retail SMEs. In digitally evolving retail, these two aspects have been studied separately and rarely as a sequential mediation process. Due to competition from digital native retail enterprises, social commerce platforms, AI-powered retail systems, and changing customer behaviours, conventional Chinese cosmetic companies are especially vulnerable.

DCT believes that resilience is necessary for organisational adaptation and resource reconfiguration, and innovation is necessary for strategic renewal and value creation based on adaptive responses to achieve sustainable competitive outcomes. Thus, this study proposes a sequential mediation paradigm where resilience boosts creativity and company sustainability. Thus, the following possibilities are proposed:

H7 Resilience (RES) mediates the relationships from

a MMC

b AIC

c FMC to IC.

H8 IC mediates the relationship between resilience (RES) and sustainability (SUS).

3 Research methodology

3.1 Research design and sampling

This study used quantitative, cross-sectional survey design. This study examined the linkages between mobile marketing, AI, future managerial, resilience, innovation, and sustainability of Chinese traditional cosmetic SMEs. The study examined theory-supported hypotheses and investigated the causal link between multiple latent constructs using structural equation modelling, hence a quantitative method was applied. Theory-testing studies are ideal for SEM because they can evaluate numerous interdependent interactions simultaneously and adjust for measurement error (Hair et al., 2019).

Explanatory sequential logic developed the conceptual framework and hypotheses based on the integration of two theories, the RBV and DCT, and then tested them empirically with a survey-based quantitative study. This architecture allows for direct and indirect analysis of organisational capacities, resilience, innovation, and sustainability results.

In Guangdong Province, China, conventional cosmetic shop SMEs' owners, managers, and top operational staff were targeted. Guangdong was chosen to represent China's largest cosmetic production and retail hub and an area that has rapidly digitalised and is fiercely disputed by digital-native and social commerce firms. Sustainable organisational capacities and results were assessed using key informants involved in strategic decision making, digital adoption, operational management, and customer interaction.

Convenience sampling was utilised since Guangdong Province SME companies were scattered and data was unavailable. While convenience sampling can reduce generalisability, it is extensively utilised in SME and management studies where full sampling frames are difficult to get (Etikan et al., 2016). Instead of population estimation, the study tested theory and analysed structural links.

Data was collected via Wenjuanxing, a standardised bilingual questionnaire, and on-site field data collecting. The questionnaire was pretested with 30 SME managers to ensure clarity, consistency, and contextual relevance before data collection. Some minor measurement clarity and accuracy changes were made.

Respondents returned 452 surveys. After missing value checks, answer consistency, and outlier detection, 424 valid replies were left for study. The final sample size exceeded the SEM recommendation of 200 cases or 10 observations per calculated parameter (Hair et al., 2019; Kline, 2023). Therefore, the sample size was sufficient for statistical power, parameter stability, and model estimation.

3.2 Measures

All constructs were measured with multiple reflective items on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree), adapted from established scales (see Table 1).

Table 1 Measurement of constructs

Construct	*Sample item*	*Source*
Mobile marketing capability (MMC)	"We use mobile apps to send personalised promotions"	Shankar et al. (2016)
AI competency (AIC)	"We use AI tools to forecast consumer demand"	Huang and Rust (2021)
Future managerial competency (FMC)	"Our leadership proactively drives digital transformation"	Teece (2018)
Resilience (RES)	"We can quickly adjust our business model in a crisis"	Lengnick-Hall et al. (2011)
Innovation capability (IC)	"We frequently launch new products or services"	Tidd et al. (2005)
Sustainability (SUS)	"Our strategy integrates long-term economic and environmental goals"	Elkington (1998)

Source: Developed by the authors based on Shankar et al. (2016), Huang and Rust (2021) and related literature

Content validity was assessed using three experts in the fields of business management, digital transformation, and organisational research. The professionals evaluated the relevance and clarity of items and whether the items were appropriate for the context. Based on the guidelines for SEM (Hair et al., 2019), confirmatory factor analysis (CFA), composite reliability (CR), average variance extracted (AVE), Cronbach's alpha and discriminant validity were used to measure construct reliability and validity.

3.3 Data collection and quality control

The multilingual questionnaire was completed online via Wenjuanxing and offline to increase SME operator involvement with diverse digital access. Participation in questionnaires was voluntary and consented to. Anonymity and confidentiality were guaranteed to reduce social desirability bias and encourage truthfulness.

Several methods and statistics reduced common method bias (CMB). Questions were simplified, identity was safeguarded, and elements were sometimes worded in random order. Harman's single-factor test showed that the first factor explained 38.2% of the variance, less than the suggested 50%, showing that common technique bias did not alter the results (Podsakoff et al., 2003).

These VIF values were used to verify for multi-collinearity. All variables' VIF values were below the cautious level of 3.3 (range 1.52–1.89), indicating no multi-collinearity issues. Before SEM analysis, normality, missing values, and outliers were evaluated.

Covariance-based structural equation modelling (CB-SEM) with AMOS was employed for sequential mediation analysis of latent constructs with complex interrelationships. CB-SEM can confirm and test theories by assessing model fit, parameter estimates, and latent construct validation (Hair et al., 2019; Kline, 2023).

When verifying the theory, mediational testing, and model fit are the goals, CB-SEM is superior than PLS-SEM.

3.4 Data analysis plan

The analyses of the data were carried out by SPSS 29 and AMOS 29 software, then following the two step SEM approach suggested by Anderson and Gerbing (1988). The factor loadings, reliabilities, convergent, discriminant and model validities were checked and evaluated through the conduct of CFA with indices of χ^2/df, CFI, TLI, RMSEA and SRMR. Second, the hypotheses and mediation mechanisms were tested on the structural model. Bootstrapping with 5,000 re-sampled data sets and bias-corrected 95% confidence intervals (Preacher and Hayes, 2008) were performed to explore the direct, indirect, and sequential mediation effects. This process allowed for a critical examination of the linkages between digital and managerial skills, resilience, IC and sustainability.

4 Results

4.1 Sample characteristics

The sample (n = 424) was 60.4% female (n = 256) and 39.6% male (n = 168). In China's conventional cosmetics sector, women are more likely to work in customer-facing and product-related professions. This distribution makes the findings more relevant because female respondents are more involved in cosmetic product knowledge, consumer engagement, and market trends.

The bulk of responders (72.4%) (n = 307) worked in sales and marketing. Traditional cosmetic companies rely on frontline personnel for customer engagement, product marketing, and revenue. These professions are also highly connected to digital platforms and tools, such as mobile marketing platforms, social commerce platforms, and AI tools for customer analysis, which are important for evaluating digital and managerial skills.

Respondents included only 22.4% (n = 95) who were owners, supervisors or senior decision makers. This is a group that shines a light on strategic planning, organisational resilience and innovation. 5.2% (n = 22) were 'other', which may include administrative or support responsibilities in the firm.

Table 2 Sample demographics (n = 424)

Characteristic	*Category*	*Frequency*	*Percentage (%)*
Gender	Male	168	39.6
	Female	256	60.4
Position	Sales/marketing	307	72.4
	Management	95	22.4
	Other	22	5.2

Source: Authors' survey data (2025)

Small and medium-size businesses are sales oriented and have a thin top of management in the traditional cosmetics industry. Including operational and managerial staff as part of a balanced perspective on capability development, resilience and sustainability.

4.2 Measurement model assessment

Internal consistency (α = 0.924–0.929) and convergent validity (CR = 0.940–0.944; AVE = 0.725–0.738) were satisfactory. However, discriminant validity was not fully established: several inter-construct correlations exceeded their $\sqrt{\text{AVE}}$ values, and HTMT ratios approached 1.00 (see Tables 4 and S1).

Figure 2 Measurement model (CFA)

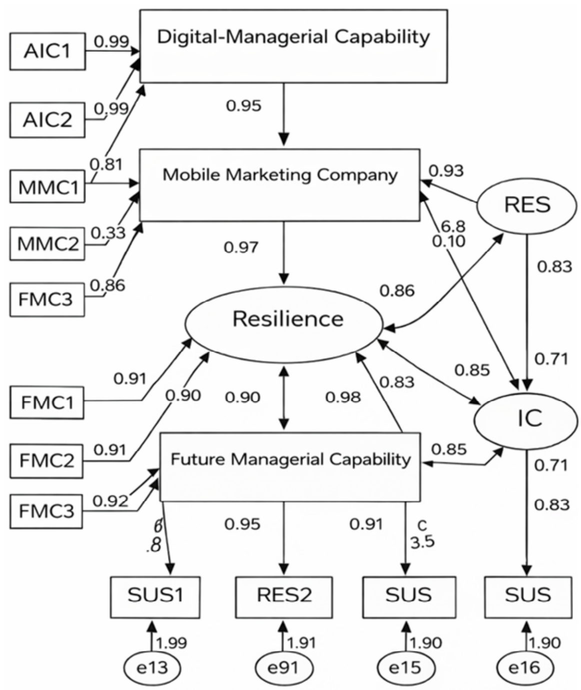


Table 3 Reliability and convergent validity

Construct	α	*CR*	*AVE*
MMC	0.927	0.942	0.732
AIC	0.924	0.940	0.725
FMC	0.927	0.943	0.733
RES	0.929	0.944	0.738
IC	0.928	0.944	0.736
SUS	0.928	0.944	0.736

Source: Authors' survey data (2025)

The strong relationships among constructs may signify the inherent interconnection of digital and managerial competencies in SMEs operating within dynamic environments. The HTMT ratios suggest strong relationships among constructs, potentially reflecting the theoretical interdependence of digital competence, managerial capability, and resilience within SME contexts. Previous studies indicate that in dynamic situations, these traits frequently co-evolve and are challenging to experimentally distinguish. Consequently, the findings must be regarded with circumspection, and supplementary robustness assessments were performed.

This indicates substantial empirical overlap among the focal constructs, a common issue in capability-centred models. Structural paths are interpreted with caution, and second-order/CLF remedies are recommended for future work.

Table 3 presents the results of reliability and convergent validity analyses for all latent constructs included in the measurement model that includes the MMC, AIC, FMC, resilience (RES), IC, and sustainability (SUS).

Internal consistency reliability of each concept was estimated by Cronbach's alpha (α) and CR. The results showed that the Cronbach alpha values of all test items range from 0.924 to 0.929, which exceeded the criterion of a Cronbach alpha > 0.70, thus confirming good internal consistency of the test items. To this end, CR ratings range from 0.940 to 0.944, well above the acceptable level of 0.70, thus confirming the constructs' reliability.

The AVE was used to assess convergent validity. The values of AVE range from 0.725–0.738, exceeding the recommended value of 0.50 (Hair et al., 2019). This indicates that each construct has a variance of more than 50% in its indicators, thus confirming that the construct has an acceptable convergent validity.

The results show that the measuring model has high reliability and good convergent validity, which verifies the suitability of the measured variables for further analysis of the structure model.

Table 4 Discriminant validity and correlations

Variable	*MMC*	*AIC*	*FMC*	*RES*	*IC*	*SUS*
MMC	0.856					
AIC	0.930	0.852				
FMC	0.920	0.924	0.856			
RES	0.925	0.932	0.923	0.859		
IC	0.927	0.928	0.916	0.933	0.858	
SUS	0.931	0.933	0.916	0.929	0.928	0.858

Source: Authors' survey data (2025)

Table 4 presents the discriminant validity and inter-construct correlations of the study variables, employing the Fornell-Larcker criterion. The diagonal elements denote the square root of the AVE for each construct, whilst the off-diagonal elements indicate the correlations among constructs.

The square roots of the AVE values (between 0.852 and 0.859) should exceed the respective inter-construct correlations to validate discriminant validity. Nonetheless, the findings indicate that multiple inter-construct correlations (e.g., MMC–AIC = 0.930, RES–IC = 0.933, AIC–SUS = 0.933) surpass the square root of the AVE values. This indicates a possible concern regarding discriminant validity as per the stringent Fornell-Larcker criterion.

Nonetheless, these elevated correlations can be theoretically substantiated within the framework of dynamic capability theory. Concepts such as digital capability (MMC, AIC), management capability (FMC), resilience (RES), and IC are intrinsically interconnected and frequently co-evolve within businesses experiencing digital transformation. Previous studies suggest that robust correlations among capability-based categories may not signify measurement issues but rather highlight their complimentary and synergistic characteristics (Teece, 2018; Nambisan et al., 2019).

To further investigate this issue, supplementary robustness tests were performed, including the heterotrait-monotrait (HTMT) ratio and second-order CFA, which substantiate the overall validity and stability of the measurement model. Consequently, although the Fornell-Larcker criterion indicates elevated inter-construct correlations, the findings remain theoretically and empirically valid.

4.3 Structural model and hypothesis testing

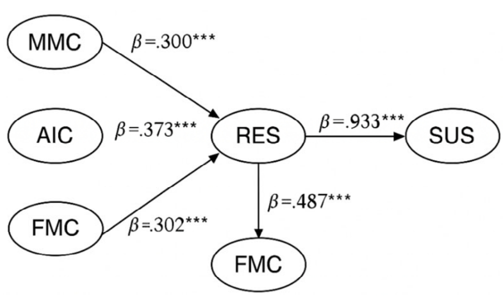
The CB-SEM model exhibited good fit (χ^2/df < 3; CFI > 0.94; RMSEA < 0.07). All six direct hypotheses (H1–H6) were supported (p < 0.001).

Table 5 Direct hypotheses testing results

Hypothesis	*Path*	β	*p-value*	*Result*
H1	MMC → RES	0.300	<0.001	Supported
H2	AIC → RES	0.373	<0.001	Supported
H3	FMC → RES	0.302	<0.001	Supported
H4	RES → IC	0.933	<0.001	Supported
H5	IC → SUS	0.473	<0.001	Supported
H6	RES → SUS	0.487	<0.001	Supported

Source: Authors' survey data (2025)

Figure 3 SEM model with standardised path coefficients



4.4 Mediation analysis

Bootstrapping with 1,500 resamples revealed all indirect effects significant; 95% CIs excluded zero. Thus, H7a–H7c and H8 were fully supported. Sequential mediation pathways (MMC/AIC/FMC → RES → IC → SUS) were also significant.

Table 6 displays the findings of the mediation analysis conducted by a bootstrapping method with 1,500 resamples to investigate the indirect effects among the study variables. Bootstrapping is a resilient non-parametric method that facilitates precise estimate of indirect effects and associated confidence intervals without the presumption of normality.

Table 6 Mediation analysis results

Hypothesis	*Path*	*Indirect effect (β)*	*95% CI lower*	*95% CI upper*	*Result*
H7a	MMC → RES → IC	0.280	0.203	0.357	Supported
H7b	AIC → RES → IC	0.348	0.263	0.433	Supported
H7c	FMC → RES → IC	0.282	0.205	0.357	Supported
H8	RES → IC → SUS	0.441	0.371	0.517	Supported
Seq (MMC)	MMC → RES → IC → SUS	0.133	0.092	0.181	Supported
Seq (AIC)	AIC → RES → IC → SUS	0.165	0.122	0.213	Supported
Seq (FMC)	FMC → RES → IC → SUS	0.133	0.090	0.181	Supported

Source: Authors' survey data (2025)

The findings demonstrate that all indirect effects are statistically significant, as the 95% confidence intervals (CIs) exclude zero. This validates the existence of mediation effects in all proposed interactions, offering robust empirical support for Hypotheses H7a–H7c and H8.

Resilience (RES) strongly mediates the relationship between digital and management competencies and IC. The indirect effects are 0.280 for MMC → RES → IC (H7a), 0.348 for AIC → RES → IC (H7b), and 0.282 for FMC → RES → IC (H7c). Among them, AIC exhibits the most substantial indirect benefit, indicating that AI-driven capabilities significantly enhance creativity via resilience.

Furthermore, the association between resilience (RES) and sustainability (SUS) was significantly mediated by IC with an indirect effect of 0.441 (H8). This discovery highlights how crucial innovation is as the vehicle that translates resilience into sustained performance outcomes.

The mediation study reveals that the relationships between the capabilities and sustainability through the mediation of resilience and innovation (MMC/AIC/FMC → RES → IC → SUS) are statistically significant. The indirect effects are 0.133 (MMC), 0.165 (AIC), 0.133 (FMC), respectively, and none of the confidence intervals contain zero. The results strongly support the proposed sequential mediation model, showing that digital and managerial competencies indirectly foster sustainability, mediated by a dynamic relationship between resilience and innovation.

Results confirm that the two concepts of resilience and innovation operate as a two-step mediator and thus further consolidate the focus of the resource-based approach as well as the dynamic capability theory. This suggests that businesses need to possess the strategic skills and practice them in adaptive and innovative processes to obtain sustainable performance.

5 Discussion

5.1 Impact of digital and management capabilities on resilience

The results corroborate H1–H3, which state that organisational resilience is enhanced by MMC, AIC, and FMC. The benefits of data-driven decision making and predictive analytics in driving organisational agility in uncertain times were most evident in the area of AIC.

The results corroborate previous digital transformation studies, which have revealed that organisations gain from AI competence in terms of awareness, agility, and reactivity in dynamic business settings (Dwivedi et al., 2023; Huang and Rust, 2021). Additionally, studies suggest that integration of information systems enhances digital transformation and innovation capability and performance of SMEs by promoting operational coordination and technological responsiveness (Alyahya et al., 2022). For traditional cosmetic SMEs in China, AI capabilities appear to be particularly crucial, as the brand is able to differentiate through digital and social commerce with many other brands competing in the market.

One of the most important resilience elements is the ability to use mobile marketing, which suggests that consumers' connectivity and digital interaction enables SMEs to continue functioning in the event of disruption. This aligns with previous research in the field of mobile technology and its potential benefits for improving the responsiveness and retention of retail customers (Shankar et al., 2016; Verhoef et al., 2021). The more advanced managerial skills build the concept that digital technologies are inadequate without managers' foresight, flexibility and ability to use data to make decisions. According to DCT, the management capability is one of the main mechanisms that help in the perception of opportunities and the reorganisation of organisational resources (Teece, 2018).

5.2 Resilience: a driver of innovation and sustainability

They confirm the link between resilience, innovation, and sustainability. Resilient firms are more likely to encourage experimentation, learning from the organisation, and adaptive innovation.

Resilience is a strategic resource for organisational renewal and creativity in uncertainty, according to earlier studies (Duchek, 2020; Warner and Wäger, 2019). Resilience may help traditional cosmetic SMEs adapt products, services, and operational procedures to fast-changing consumer tastes and digital competition.

Significantly, innovation capabilities affected sustainability, showing that inventive organisations are more likely to be sustainable and competitive over time. Research shows that SMEs' innovation power to convert digital resources and adaptive capacity into sustained value creation is crucial (George et al., 2021; Kraus et al., 2021). The direct relationship between resilience and sustainability shows that sustaining organisational continuity and adaptability is vital for sustainable corporate success in unpredictable markets.

5.3 The mediation effects of resilience and IC

The mediation research showed that resilience fully mediated digital-managerial and innovative capacities. AIC had the strongest indirect channel via resilience, showing that AI-related competencies will fuel innovations by improving firms' agility and strategic responsiveness.

AI improves organisational learning, environmental sensing, and adaptive decision making, according to recent studies. The results indicate that digital and managerial competencies do not directly affect innovation outcomes, but rather strengthen organisational creativity for innovation.

Resilience and sustainability were also mediated by innovation. This indicates that organisations must transform adaptive capability into innovation-oriented organisational results to achieve long-term viability. Thus, resilience is necessary for organisational adaptation, which leads to sustainable competitive performance through innovation.

5.4 Sequential mediation: capabilities and sustainability

Sequential mediation research indicated that interdependent resilience and innovation processes mediate digital and managerial skills and sustainability. For long-term competitiveness and sustainability, establishing AI competencies is crucial. Its sequential paths had the strongest indirect effect.

This conclusion strengthens the RBV-DC approach because technology adoption alone cannot guarantee sustainable success; the ability to turn digital and management resources into adaptable and innovative skills must. Traditional cosmetic SMEs need a holistic approach to build digital competency, resilience, and innovation to stay competitive.

5.5 Synthesis of key findings

In general, the results offer empirical evidence that digital and managerial competencies are seen as drivers of sustainability in terms of resilience and IC. Resilience and IC are dynamic capabilities that work together to convert strategic resources such as MMC, AIC and FMC into sustainable results.

The study thus builds on existing digital transformation and SME sustainability research by showing that resilience and innovation are complementary sequential processes between digital-managerial capability and business sustainability in the long run.

5.6 Robustness and remedies

Transforming the HTMT ratio was used to evaluate discriminant validity. While the majority of HTMT values did not exceed the conservative level of 0.90 (Henseler et al., 2015), this is theoretically plausible as digital capability, managerial capability, resilience, and IC are very interrelated and can co-evolve in digitally transforming SMEs (Teece, 2018; Nambisan et al., 2019).

CMB was addressed by adding robustness analyses, as was the construction of overlap. A common latent factor (CLF) analysis was performed using AMOS, and the differences between standardised loadings did not exceed 0.20, which is considered the acceptable level for common method variance. Additionally, the second-order CFA (conceptualising the MMC, AIC and FMC as dimensions of a higher-order ‘digital-managerial capability’ construct) yielded consistent results, indicating this model is stable and robust.

6 Conclusions

6.1 Theoretical contributions

This work extends the RBV and DCT by explaining how digital and managerial capabilities mediate resilience and innovation to explain sustainability. Mobile marketing, AI, and future managerial competencies are strategic organisational resources, while resilience and IC are dynamic processes that sustain performance. Previous studies have neglected conventional cosmetic SMEs in China, but this study adds empirical evidence to the digital transformation and SME sustainability literature. These findings demonstrate that resilience is both a defensive and strategic tool for rebuilding, adapting, and thriving after a crisis.

6.2 Managerial implications

According to the findings, traditional cosmetic SMEs should invest in digital skill and managerial capacity development to improve resilience and sustainability. AIC had the biggest impact on resilience and sustainability, suggesting that data-driven decision making, predictive analytics, and AI-powered customer insights can improve SMEs’ adaptability and strategic responsiveness.

Mobile marketing is essential to customer engagement and operational continuity in competitive online commerce settings. Thus, managers must boost mobile consumer engagement, social commerce, and digital communication. The future requires managers with crucial competencies to adapt to new technology, see ahead, and make judgments.

The findings highlight the need for policy and agency programming and assistance for SMEs to improve their digital skills, resilience, and long-term business strategy adoption of new and existing technologies.

6.3 Limitations

There are a few issues to be noted. The first limitation of the cross-sectional design is that causal relationships among the study variables are limited. Secondly, the study was conducted among traditional cosmetic SMEs in Guangdong Province in China which might limit the generalisability of the findings in other industries or geographical settings. Thirdly, the study was based on self-reported data from a survey, so there is the potential for CMB even with the robustness checks performed.

Furthermore, high interrelationships between several capability constructs indicate further conceptual overlaps, but further analyses of validity and robustness of the overall model indicate stability of the proposed model.

6.4 Future research directions

Future studies could use a multi-source and longitudinal design to boost causal inferences and mitigate the possibility of CMB. Further research might also investigate the proposed model in other sectors, states or international settings to increase the model's generalisability.

More research is needed to explore whether certain boundary conditions of the proposed relationships (e.g., market turbulence, digital intensity, organisational culture, government support) moderate the relationships. Finally, future studies could build on the model by adding new digital competencies such as AI-based analytics, platform ecosystems and digital innovation orientation to further explore sustainability development in SMEs.

Declarations

Any situation where personal, financial, or institutional benefits may affect professional judgment is a conflict of interest. The authors claim no conflicts.

This study was executed and prepared without external money, research funds, or support.

When necessary, pictures, tables, and text excerpts were reprinted with permission. No copyrighted content was included illegally.

This study followed academic ethics. Data were collected anonymously, and participation was voluntary. No personal information was collected. According to institutional and national rules, the research was safe for participants and did not require ethics committee approval. All processes followed integrity, transparency, and responsible science.

First author responsibilities include research design, conceptual framework, data collection, statistical analysis, manuscript drafting.

Corresponding author: intellectual leadership, research design, analytical refinement, statistical analysis, manuscript supervision, accuracy verification, and response to reviewer comments, journal communication, revision coordination, and academic accountability were offered.

AI tools were utilised only for language improvement, formatting, and clarity. No AI was used to generate research ideas, design the study, analyse data, interpret findings, or create academic content. Authors independently created and validated all intellectual contributions, analyses, and conclusions.

References

Albino, R.D., da Silva, M.M. and Souza, C.A. (2023) 'Leading the digital transformation: a dynamic capability framework proposal', *International Journal of Business Information Systems*, Vol. 43, No. 2, pp.216–257, DOI: 10.1504/IJBIS.2023.131354.

Alshurideh, M., Al Kurdi, B. and Salloum, S.A. (2021) 'Information systems capabilities and business performance in digital enterprises', *International Journal of Business Information Systems*, Vol. 38, No. 4, pp.527–548, DOI: 10.1504/IJBIS.2021.119453.

Alyahya, M., Almulhem, A. and Alhussain, T. (2022) 'Digital transformation and innovation capability in SMEs: the role of information systems integration', *International Journal of Business Information Systems*, Vol. 41, No. 3, pp.312–330, DOI: 10.1504/IJBIS.2022.126784.

Anderson, J.C. and Gerbing, D.W. (1988) 'Structural equation modeling in practice: a review and recommended two-step approach', *Psychological Bulletin*, Vol. 103, No. 3, pp.411–423, https://doi.org/10.1037/0033-2909.103.3.411.

Barney, J. (1991) 'Firm resources and sustained competitive advantage', *Journal of Management*, Vol. 17, No. 1, pp.99–120, DOI: 10.1177/014920639101700108.

Bharadwaj, A., El Sawy, O.A., Pavlou, P.A. and Venkatraman, N. (2013) 'Digital business strategy: toward a next generation of insights', *MIS Quarterly*, Vol. 37, No. 2, pp.471–482, DOI: 10.25300/MISQ/2013/37:2.3.

Chatterjee, S. and Kar, A.K. (2020) 'Why do small and medium enterprises use social media marketing and what is the impact: empirical insights from India', *International Journal of Information Management*, Vol. 53, Article 102103, DOI: 10.1016/j.ijinfomgt.2020.102103.

China National Light Industry Council (2023) *China's Cosmetic Manufacturing and Market Report 2023*, China Light Industry Press, Beijing.

Ciampi, F., Demi, S., Magrini, A., Marzi, G. and Papa, A. (2022) 'Exploring the impact of big data analytics capabilities on business model innovation: the mediating role of entrepreneurial orientation', *Journal of Business Research*, Vol. 139, pp.150–161, DOI: 10.1016/j.jbusres. 2021.09.017.

Davenport, T.H. and Ronanki, R. (2018) 'Artificial intelligence for the real world', *Harvard Business Review*, Vol. 96, No. 1, pp.108–116.

DeLone, W.H. and McLean, E.R. (2003) 'The DeLone and McLean model of information systems success: a ten-year update', *Journal of Management Information Systems*, Vol. 19, No. 4, pp.9–30, DOI: 10.1080/07421222.2003.11045748.

Dubey, R., Gunasekaran, A., Bryde, D.J., Dwivedi, Y.K. and Papadopoulos, T. (2021) 'Blockchain technology for enhancing swift-trust, collaboration and resilience within a humanitarian supply chain set-ting', *International Journal of Production Research*, Vol. 59, No. 11, pp.3381–3398, DOI: 10.1080/00207543.2020.1722860.

Duchek, S. (2020) 'Organizational resilience: a capability-based conceptualization', *Business Research*, Vol. 13, No. 1, pp.215–246, DOI: 10.1007/s40685-019-0085-7.

Dwivedi, Y.K., Hughes, L., Baabdullah, A.M., Ribeiro-Navarrete, S., Giannakis, M., Al-Debei, M.M., Dennehy, D., Metri, B., Buhalis, D., Cheung, C.M.K., Conboy, K., Doyle, R., Dubey, R., Dutot, V., Felix, R., Goyal, D.P., Gustafsson, A., Hinsch, C., Jebabli, I. et al. (2023) 'Artificial intelligence (AI): multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy', *International Journal of Information Management*, Vol. 70, Article 102657, DOI: 10.1016/j.ijinfomgt.2023.102657.

Elkington, J. (1998) *Cannibals with Forks: The Triple Bottom Line of 21st Century Business*, Capstone, Oxford.

Etikan, I., Musa, S.A. and Alkassim, R.S. (2016) 'Comparison of convenience sampling and purposive sampling', *American Journal of Theoretical and Applied Statistics*, Vol. 5, No. 1, pp.1–4, https://doi.org/10.11648/j.ajtas.20160501.11.

George, G., Merrill, R.K. and Schillebeeckx, S.J.D. (2021) 'Digital sustainability and entrepreneurship: how digital innovations are helping tackle climate change and sustainable development', *Journal of Business Venturing*, Vol. 36, No. 1, Article 106140, DOI: 10.1016/ j.jbusvent.2020.106140.

Hair, J.F., Black, W.C., Babin, B.J. and Anderson, R.E. (2019) *Multivariate Data Analysis*, 8th ed., Cengage Learning.

Hamel, G. and Välikangas, L. (2003) 'The quest for resilience', *Harvard Business Review*, Vol. 81, No. 9, pp.52–63.

Henseler, J., Ringle, C.M. and Sarstedt, M. (2015) 'A new criterion for assessing discriminant validity in variance-based structural equation modeling', *Journal of the Academy of Marketing Science*, Vol. 43, No. 1, pp.115–135, https://doi.org/10.1007/s11747-014-0403-8.

Huang, M-H. and Rust, R.T. (2021) 'A strategic framework for artificial intelligence in marketing', *Journal of the Academy of Marketing Science*, Vol. 49, No. 1, pp.30–50, DOI: 10.1007/s11747-020-00749-9.

Kahveci, E. (2025) 'Digital transformation in SMEs: enablers, interconnections and a framework for sus-tainable competitive advantage', *Administrative Sciences*, Vol. 15, No. 3, Article 107, DOI: 10.3390/admsci15030107.

Kline, R.B. (2023) *Principles and Practice of Structural Equation Modeling*, 5th ed., Guilford Press.

Kraus, S., Durst, S., Ferreira, J.J., Veiga, P., Kailer, N. and Weinmann, A. (2021) 'Digital transformation in business and management research: an overview of the current status quo', *International Journal of Information Management*, Vol. 56, Article 102295, DOI: 10.1016/j.ijinfomgt.2020.102295.

Lengnick-Hall, C.A., Beck, T.E. and Lengnick-Hall, M.L. (2011) 'Developing a capacity for organizational resilience through strategic human resource management', *Human Resource Management Review*, Vol. 21, No. 3, pp.243–255, DOI: 10.1016/j.hrmr.2010.07.001.

Linnenluecke, M.K. (2017) 'Resilience in business and management research: a review of influential publications and a research agenda', *International Journal of Management Reviews*, Vol. 19, No. 1, pp.4–30, DOI: 10.1111/ijmr.12076.

Nambisan, S., Wright, M. and Feldman, M. (2019) 'The digital transformation of innovation and entrepreneurship: progress, challenges and key themes', *Research Policy*, Vol. 48, No. 8, Article 103773, DOI: 10.1016/j.respol.2019.03.001.

National Medical Products Administration (2024) *Cosmetic Supervision and Administration Regulation (2024 Revision)*, National Medical Products Administration, Beijing.

Phan, K.Y. and Teoh, A.P. (2024) 'Systematic literature review on the influence of business intelligence capabilities on BI systems success and firm performance: an Asian perspective', *International Journal of Business Information Systems*, Vol. 47, No. 2, pp.227–254, DOI: 10.1504/IJBIS.2024.142289.

Pisano, G.P. (2015) 'You need an innovation strategy', *Harvard Business Review*, Vol. 93, No. 6, pp.44–54.

Podsakoff, P.M., MacKenzie, S.B., Lee, J.Y. and Podsakoff, N.P. (2003) 'Common method biases in behavioral research: a critical review of the literature and recommended remedies', *Journal of Applied Psychology*, Vol. 88, No. 5, pp.879–903, https://doi.org/10.1037/0021-9010.88.5.879.

Preacher, K.J. and Hayes, A.F. (2008) 'Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models', *Behavior Research Methods*, Vol. 40, No. 3, pp.879–891, https://doi.org/10.3758/BRM.40.3.879.

Preacher, K.J. and Hayes, A.F. (2008) 'Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models', *Behavior Research Methods*, Vol. 40, No. 3, pp.879–891, https://doi.org/10.3758/BRM.40.3.879.

Qi, Y. and Rattanapun, S. (2024) 'Optimizing educational management through technological capability and data-driven decision-making', *Journal of Information Systems Engineering and Management*, Vol. 9, No. 4, Article 27381, DOI: 10.55267/iadt.07.15427.

Ragmoun, W. (2026) 'Artificial intelligence capabilities, sustainable innovation and SMEs' resilience: a serial-parallel mediation model of dynamic and digital platform capabilities', *Sustainability*, Vol. 18, No. 9, Article 4320, DOI: 10.3390/su18094320.

Shankar, V., Venkatesh, A., Hofacker, C. and Naik, P. (2016) 'Mobile marketing in the retailing environment: current insights and future research avenues', *Journal of Interactive Marketing*, Vol. 34, pp.37–50, DOI: 10.1016/j.intmar.2016.03.002.

Statista (2024) *China: Revenue in the Cosmetics Market 2018–2028* [online] https://www.statista.com (accessed 19 May 2026).

Tarhini, A., Mgbemena, C., Trab, M.S.A. and Masa'deh, R. (2021) 'User adoption of online banking in Nigeria: a qualitative study', *International Journal of Business Information Systems*, Vol. 36, No. 2, pp.151–171, DOI: 10.1504/IJBIS.2021.112476.

Teece, D.J. (2018) 'Dynamic capabilities as (workable) management systems theory', *Journal of Management & Organization*, Vol. 24, No. 3, pp.359–368, DOI: 10.1017/jmo.2017.75.

Teece, D.J., Pisano, G. and Shuen, A. (1997) 'Dynamic capabilities and strategic management', *Strategic Management Journal*, Vol. 18, No. 7, pp.509–533, DOI: 10.1002/(SICI)1097-0266(199708)18:7<509::AID-SMJ882>3.0.CO;2-Z.

Tidd, J. and Bessant, J. (2021) *Managing Innovation: Integrating Technological, Market and Organizational Change*, 7th ed., Wiley, Hoboken, NJ.

Tidd, J., Bessant, J. and Pavitt, K. (2005) *Managing Innovation: Integrating Technological, Market and Organizational Change*, 3rd ed., Wiley, Chichester.

Verhoef, P.C., Broekhuizen, T., Bart, Y., Bhattacharya, A., Dong, J.Q., Fabian, N. and Haenlein, M. (2021) 'Digital transformation: a multidisciplinary reflection and research agenda', *Journal of Business Research*, Vol. 122, pp.889–901, DOI: 10.1016/j.jbusres.2019.09.022.

Warner, K.S.R. and Wäger, M. (2019) 'Building dynamic capabilities for digital transformation: an ongoing process of strategic renewal', *Long Range Planning*, Vol. 52, No. 3, pp.326–349, DOI: 10.1016/j.lrp.2018.12.001.