

The Impact Of Digital Transformation On The Resilience Of Food Msmes: The Role Of Innovation And Agility Capabilities In Rokan Hulu Regency

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Abstract

Purpose: This study examines the effect of digital transformation on the resilience of food micro, small, and medium enterprises (MSMEs) in Rokan Hulu Regency, with innovation capability and agility as parallel mediators. Methods: The manuscript uses a quantitative explanatory PLS-SEM design with four reflective constructs measured by 24 Likert-scale items. For manuscript-development purposes, the current SmartPLS 4 output is based on 348 synthetic cases and 5,000 bootstrap resamples. The results indicate positive and significant paths from digital transformation to innovation capability ($\beta = .538$), agility ($\beta = .602$), and resilience ($\beta = .183$), as well as from innovation capability ($\beta = .341$) and agility ($\beta = .368$) to resilience. Both indirect effects are significant, through innovation capability ($\beta = .184$) and agility ($\beta = .222$), while the model explains 51.8% of the variance in resilience. Measurement quality is satisfactory, with outer loadings of .830–.878, AVE of .710–.747, and HTMT below .653. Implications: The pattern suggests that affordable digital practices become more consequential for resilience when they are converted into innovation routines and rapid response capabilities. The study proposes a capability-oriented agenda for food MSME assistance in Rokan Hulu while explicitly requiring confirmation with actual field data before publication.

Keywords : agility; digital transformation; food MSMEs; innovation capability; organizational resilience

INTRODUCTION

Business resilience can no longer be understood simply as the ability to survive a crisis. In a business environment characterized by shifting demand, supply disruptions, price volatility, shifting sales channels, and accelerated digitalization, resilience demands

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the ability to anticipate pressures, maintain core functions, restore operations, and realign resources as conditions change. The capability perspective views resilience as an organizational capability built through learning, adaptation, and reconfiguration, rather than as a static characteristic that companies automatically possess (Duchek, 2020; Hillmann & Guenther, 2021; Su & Junge, 2023). This need is increasingly crucial for MSMEs because limited capital, labor, information, and operational reserves mean that even minor disruptions have the potential to have relatively significant consequences.

The context of the food industry in Riau Province concretely demonstrates this urgency. The 2024 Riau Province Micro and Small Industry Profile recorded 54,426 micro and small industrial enterprises. Of these, 31,729 are in the food industry (KBLI 10), making the food sector the largest group in the provincial MSME structure (Riau Province Central Statistics Agency, 2025). At the same time, internet use is not yet universal: 59.35% of MSMEs utilize the internet, while 40.65% have not. Among businesses that use the internet, the dominant purpose is marketing, while use for ordering raw materials, making payments, and searching for information is more limited. The same publication shows that in the food industry, only 5,886 of the 31,729 businesses registered are innovating, or approximately 18.55%. This pattern indicates a gap between the size of the food business base and the depth of business process transformation required to address uncertainty.

This gap is relevant for Rokan Hulu Regency, a region that has the character of a dispersed economy, strong local market networks, and MSMEs that are heavily dependent on direct relationships with customers and suppliers. The Rokan Hulu Regency in Figures 2026 publication provides an increasingly up-to-date socio-economic picture of the region, but sectoral data specifically mapping the digital transformation, innovation capabilities, agility, and resilience of food MSMEs in an integrated manner is still limited (Rokan Hulu Regency Statistics Agency, 2026). Therefore, research in the district context is not sufficient to simply ask whether businesses use social media, WhatsApp, marketplaces, QRIS, or digital record-keeping. A more important question is whether these digital practices actually improve businesses' ability to update products and processes and respond quickly to change, thus making them more resilient.

Digital transformation literature demonstrates that technology generates value when integrated into business models, organizational processes, decision-making, and stakeholder relationships. Digital transformation, therefore, goes beyond the digitization of transactions; it demands changes in the way organizations create and capture value (Kraus et al., 2022; Verhoef et al., 2021). In MSMEs, limited resources make the transformation process highly contextual. Matarazzo et al. (2021) demonstrate that digital technology can strengthen customer value creation when supported by dynamic capabilities, while Khurana et al. (2022) explain that digitalization during a crisis can help



MSMEs build resilience through the ability to sense change, seize opportunities, and transform business activities. These findings position technology as an enabler, not an end in itself.

The relationship between digitalization and resilience is also increasingly strengthened in recent empirical evidence. Awad and Martín-Rojas (2024) found that digital transformation drives organizational resilience through learning and innovation. Zhang et al. (2025) directly demonstrated that innovation capabilities and agile response mediate the effect of digital transformation on organizational resilience. At the MSME level, Sagala and Őri (2025) concluded that digital transformation strategies are related to the formation of resilience and antifragility, while recent literature emphasizes that changes in business capabilities—for example, digital marketing, mobile payments, data analytics, and customer relationship management—are a crucial bridge between digital adoption and MSME adaptability. Evidence from the agri-food sector also confirms that digital capabilities and a data-driven culture are more important determinants of transformation effectiveness than mere technology ownership. In the context of a recent Al-Kharaj publication, Paziah et al. (2026) also demonstrated that digital technology adoption, business innovation, and resilience are important elements in explaining MSME performance through PLS-SEM. This evidence strengthens the relevance of this research topic to the target journal discourse, while also highlighting the need to examine not only technology adoption, but also the capability mechanisms that transform technology into resilience and adaptability.

However, there are at least three limitations that still leave room for improvement. First, some studies treat digital transformation as a direct predictor of performance or resilience, so the internal mechanisms explaining how technology becomes resilient have not always been explicitly tested. Second, innovation and agility are often examined separately, even though they represent two distinct organizational responses: innovation emphasizes product, process, service, and marketing innovation, while agility emphasizes the speed of sensing and responding to change. Third, much of the evidence comes from firms or MSMEs in urban settings, general manufacturing, and countries with more established digital infrastructure. The context of food MSMEs in districts like Rokan Hulu requires testing that considers low-cost digital practices and proximity to local markets.

Dynamic capabilities theory provides a framework for bridging this gap. Teece (2018) emphasizes three groups of processes: sensing, which is recognizing changes and opportunities; seizing, which is making decisions and allocating resources to seize opportunities; and transforming or reconfiguring, which is rearranging processes and resources. In this study, digital transformation is positioned as a resource and practice that expands sensing through access to information and accelerates coordination;



innovation capability reflects the ability to seize and reconfigure through updating products, packaging, processes, marketing, and services; while agility represents the speed of changing decisions, channels, suppliers, and promotional strategies. Resilience is the capability that emerges when these processes enable businesses to prepare, survive, recover, and adapt to disruptions.

Based on this logic, digital transformation is expected to have a positive impact. It has a direct impact on resilience by expanding access to information, accelerating communication, enabling remote transactions, and providing alternative marketing channels. However, this direct influence is not theoretically necessarily the strongest pathway. Digitalization only becomes a strategic capability when information and connectivity are translated into organizational action. Therefore, this study proposes innovation and agility capabilities as parallel mediators. Innovation capabilities enable MSMEs to transform digital information into new innovations. products and processes, while agility enables businesses to react quickly to changes in raw material prices, supply disruptions, declining sales, and shifts in customer preferences (Ahmed et al., 2022; Garrido-Moreno et al., 2024; Pelletier et al., 2025; Troise et al., 2022).

This study tests seven hypotheses: H1, digital transformation has a positive effect on MSME resilience; H2, digital transformation has a positive effect on innovation capabilities; H3, Innovation capability has a positive effect on MSME resilience; H4, digital transformation has a positive effect on agility; H5, agility has a positive effect on MSME resilience; H6, innovation capability mediates the effect of digital transformation on MSME resilience; and H7, agility mediates the effect of digital transformation on MSME resilience. The purpose of this study is to explain the direct and indirect pathways in food MSMEs in Rokan Hulu Regency. The novelty offered lies in the parallel testing of two mediators, the use of constructs that represent digital practices that are close to the daily lives of food MSMEs, and the reading of the results that are directed at designing capability-based mentoring, not just technology adoption.

METHODS

The research was designed as an explanatory quantitative research with a survey approach. A cross-sectional study. The unit of analysis was micro, small, and medium food enterprises, while the intended respondents were owners or managers who understand marketing, transactions, production processes, supplier relationships, and business decision-making. The research location was Rokan Hulu Regency, Riau Province. This design was chosen because the research objective was to test the causal-predictive relationships between constructs in a model containing two mediating mechanisms simultaneously.

The research instrument consisted of 24 reflective items with a five-point Likert



scale, from 1 = strongly disagree to 5 = strongly agree. Digital Transformation (TD) was measured with six items covering the use of social media for promotion, messaging applications for customer communication, marketplaces to expand sales, digital payments, digital record-keeping, and digital coordination with suppliers/customers/partners. Innovation Capability (KI) was measured with six items regarding product updates, packaging, production processes, new marketing methods, service improvements, and openness to new ideas. Agility (AG) was measured through six items representing the speed of product adjustments, responding to cost changes, seeking alternative supplies, changing sales channels, making decisions, and adjusting promotions. MSME Resilience (RU) was measured through six items regarding readiness to face change, resilience, recovery capacity, technology and market adaptation, business relationship support, and the search for new opportunities.

Analysis using Partial Least Squares Structural Equation Modeling (PLS-SEM) on SmartPLS 4. The selection of PLS-SEM is based on the research orientation to explain and predict endogenous constructs and assess mediation paths within a single model. The evaluation was conducted in two stages. The first stage assessed the measurement model through outer loading, Cronbach's alpha, ρ_A , composite reliability (ρ_C), average variance extracted (AVE), and heterotrait-monotrait ratio (HTMT). As a guideline for interpretation, loading $\geq .70$, reliability $\geq .70$, AVE $\geq .50$, and HTMT $\leq .85$ were treated as indicators of adequate measurement quality. Collinearity was examined using the variance inflation factor (VIF), especially on the structural model predictors.

The second stage evaluates the structural model through path coefficients (β), coefficients of determination (R^2), effect sizes (f^2), and bootstrapping significance testing. Bootstrapping on the given output uses 5,000 subsamples, a two-tailed test, a significance level of .05, and percentile bootstrap confidence intervals. The hypothesis is declared supported if the direction of the coefficients matches predictions and $p < .05$ or the 95% confidence interval does not cross zero. Specific indirect effects were used to assess mediation of KI and AG. Because the direct path TD $\rightarrow$ RU and both indirect paths remained significant and in the same direction, the mediation pattern was read as complementary partial mediation.

Descriptive analysis uses the mean and Respondent Achievement Rate (TCR) to provide an overview of construct levels. TCR is calculated by comparing the mean to a maximum score of five and is expressed as a percentage. This draft uses a classification of 61–80% as the 'Good' category. Descriptive statistics do not replace PLS-SEM evaluation; their function is only to show the general trend of construct scores before interpreting the relationships between constructs.

It should be emphasized that the data underlying all tables and figures of results in this manuscript version are synthetic data of 348 cases compiled to demonstrate the



analysis flow and refine SmartPLS reporting.

RESULTS AND DISCUSSION

Descriptive Results

Descriptively, all constructs are in the 'Good' category. Digital transformation has The mean score was 3,647 with a TCR of 72.94%; the mean innovation capability score was 3,702 with a TCR of 74.04%; the mean agility score was 3,730 with a TCR of 74.61%; and the mean MSME resilience score was 3,686 with a TCR of 73.73%. The overall average was 3,691 with a TCR of 73.83%. This illustrates the general profile of respondents who gave positive but not extreme assessments of digital practices, business innovation, response speed, and resilience.

Table 1. Descriptive Statistics

Construct	Items	Mean	TCR (%)	Category
Digital Transformation (TD)	6	3,647	72.94	Good
Innovation Capability (KI)	6	3,702	74.04	Good
Agility (AG)	6	3,730	74.61	Good
MSME Resilience (RU)	6	3,686	73.73	Good
Overall	24	3,691	73.83	Good

Measurement Model

Evaluation of the measurement model showed that all outer loadings were between .830 and .878, exceeding the .70 threshold. The AG construct had loadings of .841-.860; KI .850-.878; RU .847-.863; and TD .830-.862. Internal consistency was also adequate: Cronbach's alpha ranged from .918-.932, rho_A .919-.932, and composite reliability .936-.947. All AVE values were within the range .710-.747, so each construct explains more than half of the variance of its indicators. The combination of loading, reliability, and AVE supports the convergent validity of the measurement model.

Table 2. Reliability and Convergent Validity

Construct	Loading range	Cronbach α	AVE
AG	.841-.860	.925	.728
KI	.850-.878	.932	.747
RU	.847-.863	.926	.731
TD	.830-.862	.918	.710

All indicators exceed the .70 loading guidelines; AVE values exceed .50.

Discriminant validity was assessed using HTMT. The highest value was the TD–

AG relationship of .653, followed by AG–RU .640, TD–RU .637, KI–RU .606, TD–KI .581, and AG–KI .362.

All are below the conservative limit of .85, so the constructs can be treated as empirically distinct concepts. In the structural model, the inner VIF ranges between 1.000 and 1.957; Thus, there is no indication of critical collinearity between predictors. At the indicator level, most VIFs are around 2.33–3.00, with one value slightly above the conservative threshold of 3, namely KI4 at around 3.11, but still well below the critical threshold of 5. This finding does not change the decision to retain the indicators because the loading and construct validity remain strong.

Table 3. HTMT Discriminant Validity

Construct	AG	KI	RU	TD
AG	—			
KI	.362	—		
RU	.640	.606	—	
TD	.653	.581	.637	—

Structural Models and Hypothesis Testing

The R^2 value shows that digital transformation explains 36.22% of the variance in agility and 28.91% of the variance in innovation capability. When TD, KI, and AG were used simultaneously to explain resilience, the R^2 of RU reached .518 (adjusted R^2 = .514). In other words, the model explained 51.8% of the variation in MSME resilience. This figure is substantial because resilience is a multidimensional construct that can also be influenced by external factors, such as market conditions, finances, supplier networks, infrastructure, policies, and business owner characteristics not included in the model.

As additional diagnostic information, the PLS Algorithm output yields an estimated model SRMR of .034 and an NFI of .944. These two values are reported as supplementary information, not as the sole basis for model acceptance; the primary interpretation remains based on the quality of the measurement model, collinearity, R^2 , f^2 , path coefficients, and bootstrap confidence intervals.

Direct path testing indicates that all hypotheses are directly supported. The effect of TD on KI by $\beta = .538$, $t = 14.339$, $p < .001$, with $f^2 = .407$. The effect of TD on AG is the strongest path in the model, $\beta = .602$, $t = 15.530$, $p < .001$, $f^2 = .568$. Both effect sizes indicate that digital practices have a large contribution to the formation of two intermediate capabilities in the pattern. Furthermore, KI affects RU by $\beta = .341$, $t = 7.620$, $p < .001$, $f^2 = .172$, while AG affects RU by $\beta = .368$, $t = 7.913$, $p < .001$, $f^2 = .179$. Both effects are in the moderate range. The direct path of TD to RU remains positive and significant, but is the smallest, $\beta = .183$, $t = 3.416$, $p < .001$, $f^2 = .035$, which shows a

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relatively small direct contribution after the two organizational capabilities are included.to the model.

Table 4. Direct Effects and Hypothesis Decisions

Hyp.	Path	β	t	p	95% CI	f ²	Decision
H1	TD → RU	.183	3,416	< .001	[.078, .286]	.035	Supported
H2	TD → KI	.538	14,339	< .001	[.462, .609]	.407	Supported
H3	KI → RU	.341	7,620	< .001	[.255, .429]	.172	Supported
H4	TD → AG	.602	15,530	< .001	[.522, .675]	.568	Supported
H5	AG → RU	.368	7,913	< .001	[.276, .458]	.179	Supported

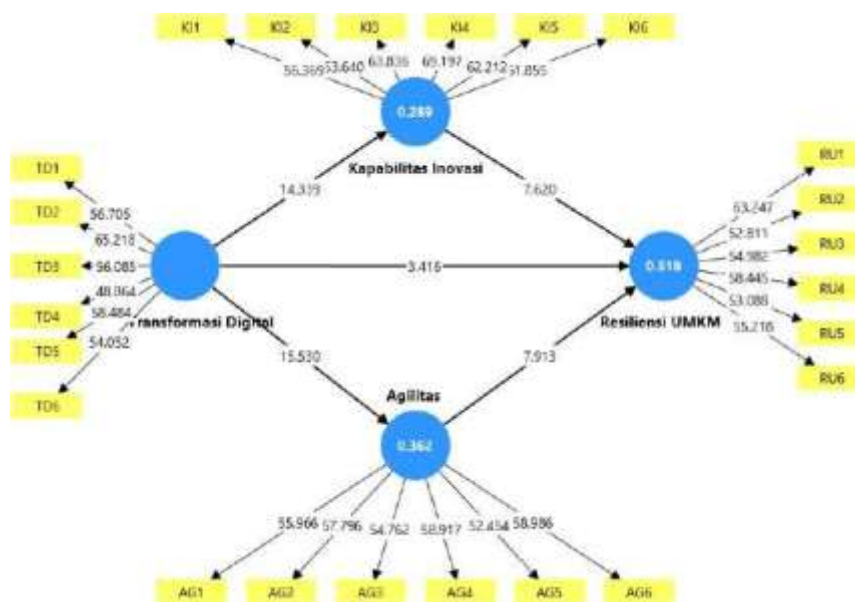


Figure 2. Bootstrapping Results:t-Statistics of Structural Paths and Outer Loadings

Mediation Effects

Both specific indirect effects were significant. The TD→KI→RU path yielded $\beta = .184$, $t = 6.493$, $p < .001$, with a 95% confidence interval [.132, .242]. The TD→AG→RU path yields $\beta = .222$, $t = 7.134$, $p < .001$, with an interval [.162, .284]. Since both intervals do not cross zero, H6 and H7 are supported. The effect through agility is greater than the effect through innovation capability, although both are substantively relevant. The total effect of TD on RU reaches $\beta = .588$ ($t = 16.676$, $p < .001$). When both indirect effects are added together, the mediation mechanism accounts for approximately .405 of the total effect, so the model pattern shows that most of the influence of digital transformation on resilience runs through changes in organizational capabilities, not just the direct path.

The direct path TD→RU remains significant after KI and AG are included, while all effects have positive signs. Thus, the for of mediation can be classified as Complementary

partial mediation. This interpretation is important: digital technology still has immediate benefits, such as maintaining communication and market access, but greater benefits emerge when technology changes how businesses innovate and react. Managerially, such results shift the focus of interventions from "how many applications are used" to "what businesses can do with those applications."

Table 5. Specific Indirect Effects

Hyp.	Indirect path	β	t	p	95% CI	Mediation
H6	TD $\rightarrow$ KI $\rightarrow$ RU	.184	6,493	< .001	[.132,.242]	Complementary partial
H7	TD $\rightarrow$ AG $\rightarrow$ RU	.222	7,134	< .001	[.162,.284]	Complementary partial

Direct TD $\rightarrow$ RU remains positive and significant; both indirect effects are positive and significant.

DISCUSSION

The first pattern of results indicates that digital transformation has a direct positive effect on resilience, but its magnitude is smaller than the pathway through innovation and agility capabilities. Theoretically, this is consistent with the view that technology is a driver of reconfiguration, not a substitute for organizational capabilities. Digitalization expands access to information, reduces communication friction, and provides alternative transaction channels, allowing for direct assisting operational continuity. However, the ability to survive and recover requires organizational processes capable of interpreting information, changing products or processes, and making timely decisions. The small direct f^2 finding (.035) highlights the limits of technological determinism: having digital channels is not synonymous with being resilient.

This interpretation aligns with Awad and Martín-Rojas (2024), who suggest that the influence of digital transformation on resilience is strengthened through learning and innovation, and with Khurana et al. (2022), who position resilience as an advanced dynamic capability that emerges through the use of technology in crisis situations. Sagala and Óri (2025) also emphasize that MSME digital transformation should be viewed as a process of developing more adaptive business capabilities. Therefore, the contribution of this study is not simply to confirm the TD $\rightarrow$ RU relationship, but rather to demonstrate why the direct path should be read alongside the capability path.

The influence of TD on IP is a powerful channel. In food MSMEs, this mechanism can occur through several simple but important processes. Social media and messaging apps provide rapid customer feedback; marketplaces display prices, demand trends, and competitor product variations; digital record-keeping makes sales patterns easier to track;



and digital coordination accelerates information exchange with suppliers. These insights can be used as input for updating flavors, sizes, packaging, services, promotional methods, and production processes. Thus, digital transformation expands sensing capacity, while innovation becomes a form of seizing and reconfiguring that turns information into valuable actions.

This relationship aligns with Matarazzo et al. (2021), who emphasize customer value creation through dynamic capabilities in the digital transformation of MSMEs, and Garrido-Moreno et al. (2024), who position innovation and resilience as critical capabilities for business performance. Zhang et al. (2025) provide even closer support for this research model, demonstrating that innovation capability is a mechanism linking digital transformation and organizational resilience. For the food sector, this relevance is strong because changes in consumer preferences, food safety, packaging, raw material prices, and distribution patterns require often incremental but iterative innovations.

The effect of TD on AG is the strongest path ($\beta = .602$; $f^2 = .568$). This result implies that the most direct contribution of digitalization is accelerating business capabilities. Sensing and responding to change. Ahmed et al. (2022) showed that digital platform capability can improve organizational agility in SMEs, while Troise et al. (2022) found that digital technology capability is an important antecedent of agility in a VUCA environment. Pelletier et al. (2025) strengthened this argument through a configurational approach to SMEs: agility does not arise from a single technology, but from a combination of resources, digital practices, and organizational conditions.

In Rokan Hulu food MSMEs, agility can be realized in very important decisions. Operational changes include changing suppliers when raw materials are disrupted, adjusting product sizes or composition when costs increase, shifting focus from offline sales to WhatsApp or social media when customer traffic declines, and changing promotions based on market response. Digital transformation reduces the time needed to obtain information and coordinate, thereby shortening decision cycles. Therefore, digital mentoring that only teaches social media account creation without procedures for monitoring demand, recording orders, or responding to customers risks generating symbolic adoption, not agility.

Innovation capability and agility both increase resilience, with medium effect sizes and relatively close coefficient magnitudes. Innovation capability helps businesses generate new options before and during disruptions; agility helps them quickly select and execute those options. These two capabilities are complementary. Innovation without agility can result in ideas that are implemented too late, while agility without innovation can allow businesses to respond quickly but with only a narrow range of actions. This explanation aligns with the dynamic capabilities view: adaptability emerges from the interaction of sensing, seizing, and reconfiguring, not from a single, isolated activity



(Teece, 2018).

The mediation effect provides the most important theoretical implications. The indirect effect through AG (.222) slightly larger than through KI (.184), while the direct effect of TD→RU is only .183. This means that digital transformation becomes more meaningful for resilience when it first improves the way the organization acts. Zhang et al. (2025) found a consistent pattern through innovation capability and agile response. This study extends this logic to the design of food MSMEs in the district context and uses indicators close to low-cost practices—social media, messaging apps, marketplaces, digital payments, and simple record-keeping—so that capability mechanisms do not depend on advanced technology.

The Riau context provides a strong rationale for prioritizing such mechanisms. Statistics Indonesia (BPS) data shows that the food industry is the largest segment of the province's micro, small, and medium enterprises (MSMEs), but internet use is still not widespread, and innovation in the food industry remains relatively limited. Among the 22,120 small and medium enterprises (SMEs) that have not yet used the internet, the most common reason is a perceived lack of internet access, followed by limited knowledge of how to use it and a lack of devices (Riau Province Central Statistics Agency, 2025). This data shows that connectivity is not the only issue. Perceived benefits, ability to use information, and readiness to change business practices also determine whether digitalization generates value. In other words, interventions need to bridge adoption and capability.

The first practical implication is the need for a four-construct diagnosis before providing assistance programs. MSMEs with low TD require a foundation in the form of device access, digital literacy, transaction recording, digital catalogs, and electronic payments. MSMEs with high TD but low KI require training that transforms customer data into product, packaging, and service updates. MSMEs with high TD but low AG This requires rapid response protocols, alternative supplier lists, cost and demand monitoring, and sales channel relocation scenarios. MSMEs with relatively high IQ and AG can be directed towards strengthening analytics, process integration, and market expansion. This segmentation makes policies more targeted than uniform digital training.

The second implication relates to program evaluation. The success of digital mentoring should not be measured solely by the number of marketplace accounts, QRIS transactions, or training participants. Outcome indicators should include changes in capabilities: whether customer response times are faster, whether pricing decisions are more data-driven, whether backup suppliers are available, whether product updates are more frequent, and whether businesses have alternative channels in place in the event of disruptions. Outcomes that more closely align with innovation capability and agility will provide a stronger picture of the path to resilience.



The third implication is the importance of ecosystems. Food MSMEs rarely build resilience alone, as business continuity depends on raw material suppliers, logistics services, digital platforms, payment institutions, customers, resellers, local governments, and supporting institutions. Digital transformation can strengthen these networks if it focuses on coordination and information exchange. Therefore, district-level programs can combine digital marketing training with inventory management, payments, supplier management, complaint handling, and disruption response. This ecosystem approach is consistent with literature that positions MSME resilience as the result of the interaction of internal capabilities and environmental support.

In terms of scientific contribution, this model establishes a more layered relationship between digital resources, organizational capabilities, and resilience outcomes. Digital transformation is at the enablement layer; innovation and agility capabilities are at the conversion layer; and resilience is at the adaptive outcome layer. This framework helps explain why two businesses using similar technologies can demonstrate different levels of resilience. The difference lies not necessarily in the applications themselves, but in the ability to transform connectivity and data into updates and responses. This is the argument that makes parallel mediation relevant both theoretically and practically.

However, the interpretation of the results must be strictly guarded. First, the output used. The model must examine the actual conditions of Rokan Hulu's food MSMEs, compare sub-districts, or make population-based policy claims. Second, even when replaced with field data, the cross-sectional design limits temporal and causal inference. Third, the construct is measured through owner/manager perceptions, so common method bias and social desirability must be considered. Fourth, the model does not incorporate factors such as access to financing, business age, workforce scale, product type, raw material volatility, owner digital competence, and infrastructure quality. Further research could use longitudinal, multi-respondent data, or combine surveys with transaction and interview data to strengthen external validity and causal mechanisms.

CONCLUSION

The results show a pattern consistent with the dynamic capabilities framework: digital transformation is positively related to innovation capabilities, agility, and resilience; innovation capabilities and agility are also positively related to resilience. The strongest path is digital transformation to agility, followed by digital transformation to innovation capabilities. The direct effect of digital transformation on resilience remains significant but has a negative effect. Small size, while both effects are not directly significant. Thus, the model places innovation and agility as the main mechanisms that transform the use of technology into the ability to survive, recover and adapt.

Conceptually, these results strengthen the argument that the digitalization agenda for



food MSMEs should not stop at app adoption. Strategic value emerges when social media, messaging apps, marketplaces, digital payments, digital record-keeping, and Online coordination is used to generate information that drives innovation and accelerates decisions. Practically, local governments and supporting institutions can use the digital-innovation-agility-resilience profile to differentiate intervention needs: digital foundations for businesses that have not yet digitized, innovation strengthening for digital users who have not yet been able to update their offerings, and agility strengthening for businesses that have not yet responded quickly to change.

The most fundamental limitation of the current manuscript is that the analyzed data is synthetic. Therefore, this article should be treated as a methodological and editorial draft adapted to the journal's structure, not as final empirical evidence. Before submission, researchers need to replace or verify all statistics with primary data from Rokan Hulu food MSMEs, complete the sampling procedure and respondent profiles, ensure research ethics compliance, and repeat the PLS algorithm and bootstrapping on actual data. After such verification, the model can make a more credible empirical contribution to the literature on digital transformation and MSME resilience in non-metropolitan areas.

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