http://dx.doi.org/10.18623/rvd.v22.n2.3278

DIGITAL-GREEN INTEGRATION ENABLING TRADITIONAL FOOD SMES PERFORMANCE: A STRUCTURAL MODEL OF SUSTAINABLE CULINARY HERITAGE VALUE PRESERVATION

INTEGRAÇÃO DIGITAL-VERDE QUE FACILITA O DESEMPENHO DE PMES DE ALIMENTOS TRADICIONAIS: UM MODELO ESTRUTURAL DE PRESERVAÇÃO SUSTENTÁVEL DO VALOR DO PATRIMÔNIO CULINÁRIO

Article received on: 11/12/2023
Article accepted on: 30/01/2024

Andriyansah*
*Universitas Terbuka (UT)
Tangerang Selatan, Banten, Indonesia
Orcid: https://orcid.org/0000-0002-4851-2617
andri@ecampus.ut.ac.id

Nengah Sukendri **
** Institut Agama Hindu Negeri Gde Pudja Mataram(IAHN Gde-Pudja Mataram)
Mataram, Nusa Tenggara Barat, Indonesia
Orcid: https://orcid.org/0000-0002-2635-3109
sukendri@iahn-gdepudja.ac.id

The authors declare that there is no conflict of interest

Abstract
This study investigates the interrelationship between digital transformation alignment, eco-digital resilience, and green technology adoption in Indonesian traditional culinary MSMEs. Using a mixed-methods approach with quantitative dominance (N=334) and supporting qualitative analysis (25 in-depth interviews), this research examines how traditional culinary businesses integrate digital technologies and sustainable practices while preserving culinary authenticity as their competitive advantage. PLS-SEM analysis reveals significant positive relationships between eco-digital resilience and green technology adoption speed. The study introduces a novel Eco-Digital Resilience (EDR) construct that captures MSMEs' capacity to adapt to technological and environmental demands without compromising cultural essence. Findings indicate a paradigm shift in perception, where digitalization is increasingly viewed as an enabler rather than a threat to culinary heritage preservation. Economically, sustainable culinary MSMEs command a 15-20% price premium with a 14-month payback period for green technology investments, while digital systems reduce food waste by 35% and gas usage by 25%. Demographically, the research identified female dominance (54.7%) in sector leadership but concerningly low youth participation (9.3%), signaling a regeneration crisis threatening traditional culinary knowledge transmission. The

Resumo
Este estudo investiga a inter-relação entre o alinhamento da transformação digital, a resiliência ecodigital e a adoção de tecnologias verdes em MPMEs da culinária tradicional indonésia. Utilizando uma abordagem de métodos mistos com dominância quantitativa (N=334) e apoiando uma análise qualitativa (25 entrevistas em profundidade), esta pesquisa examina como empresas de culinária tradicional integram tecnologias digitais e práticas sustentáveis, preservando a autenticidade culinária como sua vantagem competitiva. A análise PLS-SEM revela relações positivas significativas entre a resiliência ecodigital e a velocidade de adoção de tecnologias verdes. O estudo apresenta um novo construto de Resiliência Ecodigital (RED) que captura a capacidade das MPMEs de se adaptarem às demandas tecnológicas e ambientais sem comprometer a essência cultural. Os resultados indicam uma mudança de paradigma na percepção, onde a digitalização é cada vez mais vista como um facilitador, em vez de uma ameaça, à preservação do patrimônio culinário. Economicamente, as MPMEs da culinária sustentável apresentam um prêmio de preço de 15 a 20%, com um período de retorno de 14 meses para investimentos em tecnologia verde, enquanto os sistemas digitais reduzem o desperdício de alimentos em 35% e o consumo de gás em 25%. Em termos demográficos, a

study proposes a hybrid traditional-digital conceptual framework that reconciles the apparent dichotomy between cultural preservation and technological innovation. This integration enables culinary MSMEs to not only survive digital disruption but contribute to sustainable preservation of Indonesia's rich culinary heritage. These findings have significant implications for policymakers, particularly in cultural preservation, tourism development, and gender-responsive MSME support programs.

Keywords: Digital Transformation. Eco-Digital Resilience. Green Technology. Sustainability. Traditional-Digital Hybridity. Spatial-Cultural Contingency.

pesquisa identificou predominância feminina (54,7%) na liderança do setor, mas uma participação juvenil preocupantemente baixa (9,3%), sinalizando uma crise de regeneração que ameaça a transmissão do conhecimento culinário tradicional. O estudo propõe uma estrutura conceitual híbrida tradicional-digital que concilia a aparente dicotomia entre preservação cultural e inovação tecnológica. Essa integração permite que as MPMEs da culinária não apenas sobrevivam à disrupção digital, mas também contribuam para a preservação sustentável do rico patrimônio culinário da Indonésia. Essas descobertas têm implicações significativas para os formuladores de políticas, particularmente em preservação cultural, desenvolvimento do turismo e programas de apoio às MPMEs com perspectiva de gênero.

Palavras-chave: *Transformação Digital. Resiliência Ecodigital. Tecnologia Verde. Sustentabilidade. Hibridez Tradicional-Digital. Contingência Espacial-Cultural.*

1 INTRODUCTION

The archipelago's culinary heritage is a complex ecosystem that goes beyond mere gastronomic practices, reflecting a dynamic and sustainable cultural identity(Waiari et al., 2021). The fundamental paradox facing traditional culinary MSMEs in the digital era is how to integrate technology and sustainable practices without sacrificing the cultural authenticity that is the core value of their products. While digitalisation and sustainability have become strategic imperatives, most traditional culinary MSMEs still face difficulties in adopting these two elements simultaneously and in an integrated manner(Purnama et al., 2022; Vásquez et al., 2024).

This issue is all the more urgent given the dual impact of digital disruption and the sustainability crisis on the traditional culinary sector. On the one hand, digital transformation has fundamentally changed consumer preferences and business models in the culinary industry(Sgroi, 2023). On the other hand, environmental sustainability challenges are forcing culinary MSMEs to reconsider their production practices, raw material procurement, and waste management(Virmani et al., 2022). The urgency of addressing this issue is all the more critical given that traditional culinary MSMEs are the backbone of Indonesia's gastronomic economy and irreplaceable carriers of cultural

values. This issue leads to a critical question: How can traditional culinary MSMEs effectively integrate digitalisation and green practices without losing the culinary authenticity that is their competitive advantage?

A survey conducted by the Ministry of Cooperatives and SMEs in 2022 revealed that only 32% of a total of 8.7 million culinary MSMEs have undertaken significant digitalisation, defined as the use of at least two digital platforms for business operations (Fauzi & Sheng, 2022). More concerning, the level of green technology adoption is still low, with only 18 per cent of culinary MSMEs implementing sustainable waste management practices and 23 per cent using renewable energy in their operations. This gap indicates an urgent need for a comprehensive and contextualised transformation model that fits the realities of Indonesian culinary MSMEs.

Bachtiar et al., 2023; Astuty et al., 2024 explore MSME digitalisation and sustainable practices in the context of culinary businesses but there is a significant gap in research that integrates these two aspects, especially in the context of culinary heritage preservation. Díaz-Pelaez et al., (2024)examines the impact of digitalisation on MSME performance but does not explore sustainability aspects. Meanwhile, Lopes et al. (2020) focus on green practices in the culinary industry without comprehensively considering digitalisation factors. Pangarso et al., (2022) identified the need for an integrative approach that combines digitisation, sustainability and cultural heritage preservation, but has yet to develop a structural model that empirically tests these relationships.

The novelty of this research lies in the development and operationalisation of a new Eco-Digital Resilience (EDR) construct that explains the capacity of culinary MSMEs to adapt to digital and environmental demands without losing their cultural essence. EDR does not simply encourage digitalisation, but presents a holistic approach that considers the balance between environmental sustainability, digital transformation and preservation of traditional culinary practices(Gomez-Trujillo & Gonzalez-Perez, 2022). This innovative concept extends the boundaries of theoretical understanding of organisational resilience in the context of digital transformation and green transition in traditional culinary MSMEs.

The structural model of this study is built on the integration of three complementary theoretical foundations. First, Resource Orchestration Theory explains how culinary MSMEs can strategically configure traditional and digital resources to create unique value(Sari et al., 2024). This theory provides a framework for understanding

how culinary MSMEs can utilise traditional recipes along with digital technology to create a unique value proposition (Florez et al., 2022). Second, the Digital Sustainability Framework integrates digitalisation and sustainability perspectives in a holistic framework that considers the environmental implications of digital transformation (Kunkel & Matthess, 2020).

Yin et al., (2024) demonstrates that effective digital-green integration can result in operational efficiencies of up to 35% within the MSME sector. Third, Cultural Heritage Innovation Theory provides a conceptual foundation for technological innovations that strengthen the authenticity of culinary heritage(Del Soldato & Massari, 2024; Vrontis et al., 2021). Zakrzewska et al., (2024)identified that successful innovation in the context of culinary heritage must maintain core cultural markers while adapting peripheral elements to meet contemporary demands.

Based on this theoretical foundation, this study develops five main hypotheses that test the relationship between EDR, Digital Transformation Alignment (DTA), Green Technology Integration (GTI), Operational Excellence (OE), and organisational performance. H1 states that EDR has a positive effect on DTA, based on the findings of Garrido-Moreno et al., (2024) that high resilience capacity facilitates effective digital alignment. H2 tested the positive influence of EDR on GTI, supported by the study of Dwivedi et al., (2022) which suggests that MSMEs with high EDR scores implement more green technology solutions. H3 and H4 respectively test the positive influence of DTA and GTI on OE, based on empirical evidence from Huang et al., (2023); Wang et al., (2023). H5 tests the positive effect of OE on organisational performance, in line with the finding of Tortorella et al., (2021)on the relationship between operational excellence and business performance.

The conceptual framework of this research is shown in Figure 1, illustrates the structural relationships between the key constructs of the study. EDR acts as an antecedent that influences DTA and GTI. DTA and GTI serve as mediating variables that influence OE, which in turn influences organisational performance. The model assumes that effective digital-green integration drives operational excellence and better organisational performance through the mechanisms of process efficiency, quality standardisation and waste reduction. The framework highlights the role of EDR as a fundamental construct that enables traditional culinary MSMEs to adapt to the demands of digitalisation and sustainability without sacrificing culinary authenticity.

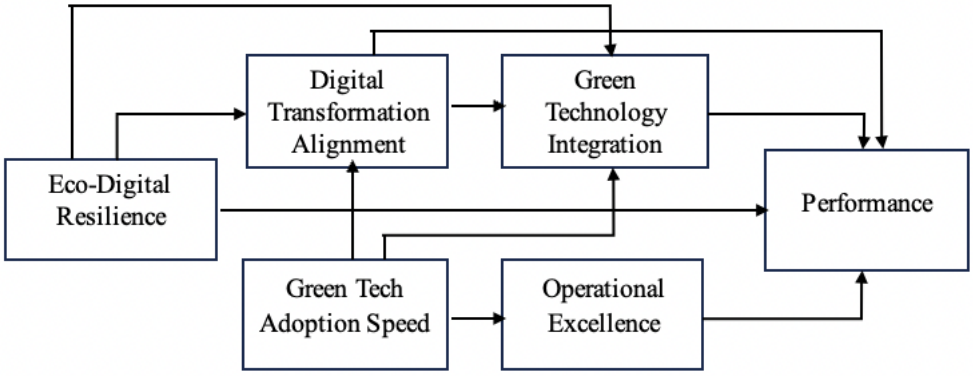
As a concrete example of the implementation of this model, Rumah Makan Padang Sederhana successfully implemented an app-based digital ordering system while maintaining traditional cooking techniques and implementing a system of processing food waste into organic fertiliser. Similarly, Kedai Kopi Kokolaka in Bali implemented a digital supply chain tracking system to ensure transparency of traditional coffee bean sourcing, while using coffee grounds as raw material for craft products, creating a profitable circular economy. These two examples illustrate how EDR enables culinary MSMEs to integrate digital technology and green practices while strengthening the authenticity of their culinary products.

In the context of tourism and cultural diplomacy, this model has fundamental implications: strengthening national culinary identity through the integration of technology and sustainability can enhance Indonesia's gastronomic appeal on the global stage. Through this integrative approach, culinary MSMEs can not only survive in the digital era, but also contribute to the sustainable preservation of the archipelago's culinary heritage. This fundamental research aims to comprehensively explore how culinary MSMEs can integrate digital technology and green practices without losing authenticity, while answering the question: How does digital resilience strengthen technological adaptation in the context of traditional culinary MSMEs? To what extent can digital transformation serve as an instrument of culinary heritage preservation? And how can sustainable practices integrated with digital technology improve the organisational performance of culinary MSMEs?

By examining the complex interactions between digitalisation, sustainability and culinary heritage, this research generates not only theoretical contributions, but also practical implications that can guide the transformation of culinary MSMEs in Indonesia towards a more sustainable, digitalised and culturally authentic future.

Figure 1:

Conceptual Model of Digital-Green Integration for Traditional Culinary MSME Performance



2 METHODOLOGY

This research applies a mixed method approach with quantitative dominance supported by qualitative analysis to explore digital-green integration in traditional Indonesian culinary MSMEs. A sequential explanatory design was chosen to comprehensively understand how culinary MSMEs integrate digital technology and green practices without sacrificing the culinary authenticity that is their competitive advantage (Yuwono et al., 2024). Data were collected from 334 traditional culinary MSMEs in five major Indonesian culinary cities such as Yogyakarta, Padang, Bali, Surakarta, Surabaya and Bandung using purposive sampling techniques with the criteria of at least three years of operation, serving traditional Indonesian food, and having at least five employees. Sample size determination followed the recommendations of Hair Jr et al., (2021) with at least ten times the largest number of structural paths leading to the constructs in the model. The data collection process was carried out after the respondent gave verbal consent, this was done to obtain non-randomised assurance. In accordance with the code of ethics and applicable regulations, researchers ensured participant confidentiality and data protection in accordance with regulations, not providing any information to third parties without the respondent's permission.

Primary data collection was conducted through a structured questionnaire using a 7-point Likert scale delivered through a combination of online and face-to-face surveys to accommodate respondents' varying levels of digital literacy. To enrich the quantitative

understanding, 25 MSME owners were selected for in-depth interviews based on variations in performance and technology adoption levels. This approach is aligned with (Fauzi & Sheng, 2022) which emphasises the importance of understanding the specific context in the digitisation of traditional culinary MSMEs.

The operationalisation of research variables is based on theoretical constructs developed from the literature. Eco-Digital Resilience (EDR) is measured through technological adaptability, disruption recovery, and environmental integration in accordance with the conceptualisation of EDR (Mishra et al., 2024; Montresor & Vezzani, 2023). Green Tech Adoption Speed (GTAS) Operationalised through innovation timeframe, speed of implementation, level of acceptance, and learning capacity based on a framework of (Avenali et al., 2024; Haque & Rashid, 2023). Operational Excellence (OE) measured by production efficiency, quality consistency, supply management, waste minimisation, and resource optimisation follows (Naik et al., 2024; Shahzad et al., 2024).

Digital Transformation Alignment (DTA) operationalised through tradition conformity, system integration, vision coherence, and leadership commitment based on (Hernández-Cuadra & Fernández-Fernández, (2024); Prashar, (2023). While Green Technology Integration (GTI) is measured through energy efficiency, waste reduction, material sustainability, production friendliness, packaging innovation, and emissions monitoring in accordance with (Barca et al., 2024; Moshood et al., 2022). Organisational performance (PERF) is measured through seven comprehensive indicators: revenue growth, customer satisfaction, cost efficiency, cultural heritage preservation, environmental impact, business resilience, and market reputation that refer to a framework of (Barnes, 2022; Martínez-Falcó et al., 2024).

Quantitative data analysis using variance-based Structural Equation Modeling (PLS-SEM) with SmartPLS 4 to test structural models that integrate Resource Orchestration Theory (Zeng et al., 2023), Digital Sustainability Framework (Robertsone & Lapiņa, 2023), and Cultural Heritage Innovation Theory(Trunfio et al., 2022). The choice of PLS-SEM is based on its ability to handle complex models with formative and reflective indicators, and does not require the assumption of data normality (J. Hair & Alamer, 2022). The structural model tests ten main hypotheses linking EDR, DTA, GTI, OE, and organisational performance, following the conceptual framework developed from the research (Barbieri et al., 2023; Duchek et al., 2020; Margherita et al., 2021).

Qualitative analysis used a thematic analysis approach to the interview transcripts to identify patterns, barriers, and supporting factors in the implementation of digital-green integration. The triangulation of data from both methods allows for a more holistic understanding of the complexities of integrating digital technologies and green practices in the context of preserving Indonesia's culinary heritage, in line with the urgencies identified (Kurniawan et al., 2024) on the importance of sustainable strategies for traditional culinary MSMEs in the digital era. This methodological approach directly responds to the research gaps identified in this study (Mengist et al., 2020; Van Hoek, 2020) on the need for an integrative approach that combines digitisation, sustainability and cultural heritage preservation in the context of traditional culinary MSMEs.

3 RESULT AND DISCUSSION

3.1 Respondent identity

The survey of 344 traditional culinary MSMEs from six major cities in Indonesia aims to identify the demographic characteristics of business owners as a basis for planning more targeted development and empowerment strategies. as shown in Table 1.

Table 1.

Demographic Profile of Respondents

Item	Classification	Frequency	%		Item	Classification	Frequency	%
Gender	Male	156	45.3%		Type of culinary	Traditional cuisine	124	36.0%
	Female	188	54.7%			Regional food specialities	86	25.0%
Age	< 25	32	9.3%			Traditional snacks	52	15.1%
	26-35	87	25.3%			Traditional drinks	38	11.0%
	36-45	124	36.0%			Local food processing	44	12.8%
	46-55	78	22.7%		Working areas	Yogyakarta	68	19.8%
	> 55	23	6.7%			Padang	55	16.0%
Length of time as MSME	< 3	47	13.7%			Bandung	62	18.0%
	3-5	82	23.8%			Bali	59	17.2%
	6-10	116	33.7%			Surabaya	58	16.9%
	11-15	63	18.3%			Surakarta	42	12.2%
	> 15	36	10.5%					
Education	SD/SMP	24	7.0%					
	SMA/SMK	138	40.1%					
	Diploma	67	19.5%					

	S1	103	29.9%					
	S2/S3	12	3.5%					

The survey results show the dominant involvement of women (54.7%) in the traditional culinary MSME sector, reflecting the central role of women in preserving Indonesia's culinary heritage. This phenomenon is also in line with the characteristics of the culinary industry, which is more gender-inclusive than other industrial sectors. In terms of age, the majority of MSME players (58.7%) are in the productive age range of 36-55 years, with the highest concentration in the 36-45 years group (36%). This data indicates that traditional culinary businesses tend to be run by individuals who have matured in experience. The relatively low participation of the younger generation under 25 years old (9.3%) indicates a regeneration gap that needs to be addressed for the sustainability of culinary heritage.

In terms of business sustainability, the majority of MSMEs (33.7%) have been operating for 6-10 years, indicating good survival. However, only 10.5 per cent have survived for more than 15 years, indicating challenges in maintaining long-term sustainability. Geographical distribution is relatively even across the six research cities, with Yogyakarta as the highest centre (19.8%), reflecting the richness of culinary variants in different parts of Indonesia. In terms of education, the majority of MSME players have medium (SMA/SMK - 40.1%) and high education (S1 - 29.9%), indicating the potential for knowledge-based business development and innovation.

Preferences for culinary types are dominated by traditional cuisine (36%) and regional specialities (25%), confirming the strong value of local wisdom in Indonesia's culinary MSME ecosystem. Furthermore, the cross-tabulation data between working areas and culinary types of MSMEs shows a very interesting distribution pattern of culinary characteristics in different regions of Indonesia, which we show in Table 2.

Table 2:

Distribution of Respondents Based on Work Area and Type of MSME Traditional Culinary

Working Area	Traditional Cuisine	Regional food specialities	Traditional snacks	Traditional drinks	Local food processing	Total
Yogyakarta	23 (6.7%)	15 (4.4%)	11 (3.2%)	8 (2.3%)	11 (3.2%)	68 (19.8%)
Padang	27 (7.8%)	16 (4.7%)	5 (1.5%)	3 (0.9%)	4 (1.2%)	55 (16.0%)
Bandung	19 (5.5%)	14 (4.1%)	13 (3.8%)	9 (2.6%)	7 (2.0%)	62 (18.0%)
Bali	21 (6.1%)	18 (5.2%)	7 (2.0%)	6 (1.7%)	7 (2.0%)	59 (17.2%)
Surabaya	22 (6.4%)	12 (3.5%)	9 (2.6%)	7 (2.0%)	8 (2.3%)	58 (16.9%)
Surakarta	12 (3.5%)	11 (3.2%)	7 (2.0%)	5 (1.5%)	7 (2.0%)	42 (12.2%)
Total	124 (36.0%)	86 (25.0%)	52 (15.1%)	38 (11.0%)	44 (12.8%)	344 (100%)

Padang recorded the highest percentage for the traditional cuisine category (7.8%), reflecting the strong Minangkabau culinary tradition that has an established ecosystem and distribution channels nationwide. Conversely, Padang has the lowest percentage for traditional beverages (0.9%), indicating that there is still room for development in this sector. Bali shows an interesting balance with a dominance in regional specialities (5.2%), illustrating the strong local culinary identity that has grown in tandem with the tourism industry. This characteristic contrasts with Surakarta, which has the lowest percentage of traditional cuisine (3.5%), but shows a relatively even distribution across all culinary categories.

Bandung stands out in the traditional snacks category (3.8%), reflecting its position as a long-standing centre of innovation for light culinary delights. Meanwhile, Yogyakarta showed a good balance across categories with a particular emphasis on local food processing (3.2%), in line with its reputation as a centre for local wisdom-based culinary creativity. Overall, traditional cuisine dominated across all regions (36.0%), emphasising Indonesian cuisine's strong foundation in traditional roots. However, traditional beverages are consistently the category with the lowest percentage (11.0%) in almost all regions, indicating that there are still wide open opportunities for development and innovation in this sector.

3.2 Measurement model

The measurement model in PLS tests the validity and reliability of the constructs by analysing the loading factor, Cronbach's alpha, composite reliability, dan average variance extracted (AVE) (Hair Jr et al., 2021a).

Table 3:

Validity and reliability criteria for each construct

Concept	Item	Loading Factor	Cronbach Alpha	Composite reliability	AVE	VIF
Eco-Digital Resilience (EDR)						
1. Technological adaptability	TA	0.843	0.803	0.883	0.716	1.850
2. Disruption recovery	DR	0.846				1.576
3. Environmental integration	EI	0.850				1.858
Green Tech Adoption Speed (GTAS)						
1. Innovation timeframe	IT	0.837	0.847	0.897	0.685	2.134
2. Implementation velocity	IV	0.799				1.815
3. Acceptance level	AL	0.832				1.838
4. Learning capacity	LC	0.841				1.607
Operational Excellence (OE)						
1. Production efficiency	PE	0.816	0.861	0.900	0.642	2.066
2. Quality consistency	QC	0.764				1.757
3. Supply management	SM	0.841				2.152
4. Waste minimization	WM	0.803				2.364
5. Resource optimization	RO	0.782				2.333
Digital Transformation Alignment (DTA)						
1. Tradition compatibility	TC	0.798	0.807	0.872	0.631	1.714
2. System Integration	SI	0.794				1.751
3. Vision coherence	VC	0.769				1.694
4. Leadership commitment	LC	0.815				1.927
Green Technology Integration (GTI)						
1. Energy efficiency	EE	0.814	0.879	0.908	0.623	2.078
2. Waste reduction	WR	0.773				1.985
3. Material sustainability	MS	0.797				2.004
4. Production ecofriendliness	PE	0.781				
5. Packaging innovation	PI	0.798				2.138
6. Emission monitoring	EM	0.771				1.831
Performance (PERF)						
1. Revenue growth	RG	0.788	0.904	0.924	0.636	2.243
2. Customer Satisfaction	CS	0.795				2.264
3. Cost Efficiency	CE	0.778				1.908

Concept	Item	Loading Factor	Cronbach Alpha	Composite reliability	AVE	VIF
4. Heritage Preservation	HP	0.811				2.320
5. Environmental Impact	EI	0.811				2.216
6. Business Resilience	BR	0.779				1.978
7. Market Reputation	MR	0.818				2.288

The measurement model analysis results show that all constructs in the research model have satisfactory psychometric properties. Evaluation of the measurement model shown in table 3 includes aspects of reliability and validity to ensure the feasibility of constructs before testing the structural model. In terms of indicator reliability, all loading factor values are > 0.7 (0.764 to 0.850), exceeding the recommended threshold value of 0.7(Hair Jr et al., 2021b). The highest loading value is found in the Environmental Integration indicator (EI = 0.850) of the Eco-Digital Resilience construct, indicating that the integration of environmental aspects is the indicator that most strongly reflects the eco-digital resilience of traditional culinary MSMEs. Meanwhile, the lowest loading is found in the Quality Consistency indicator (QC = 0.764) for the Operational Excellence construct, although it is still within acceptable limits.

Internal consistency reliability is indicated by the Cronbach's Alpha and Composite Reliability (CR) values which are all > 0.7. Cronbach's Alpha values ranged from 0.803 to 0.904, while higher CR values ranged from 0.872 to 0.924, indicating that all constructs had good internal consistency. The Performance (PERF) construct showed the highest reliability (CA = 0.904; CR = 0.924), reflecting the robustness of measuring organisational performance through seven comprehensive indicators.

Convergent validity was tested through Average Variance Extracted (AVE), with all constructs showing values > 0.5 (ra 0.623 to 0.716). The highest AVE value belongs to the Eco-Digital Resilience construct (0.716), indicating that 71.6% of the indicator variance can be explained by the EDR construct. The lowest AVE value belongs to Digital Transformation Alignment (0.631), but still well above the minimum required value. This result confirms that the indicators used have sufficient correlation with their latent constructs, in accordance with the criteria recommended by (van Bork et al., 2021).

To check for multicollinearity, the Variance Inflation Factor (VIF) was analysed with all values being < the recommended 5.0 (1.576 to 2.364). The highest VIF value was found in the Waste Minimisation indicator (WM = 2.364) of the Operational Excellence

construct, but it is still far < 5.0 which indicates the absence of serious multicollinearity problems. Overall, the measurement model evaluation results show that the research instruments have good validity and reliability to measure the constructs under study. All statistical parameters fulfil the criteria set out in the SEM-PLS literature(J. F. Hair et al., 2021; van Bork et al., 2021).

Table 4 shows Discriminant Validity (HTMT) is a measure that assesses the extent to which the constructs in the model are truly distinct from one another. A low HTMT value (<0.85) indicates that each construct measures a unique and distinct concept, not overlapping with other constructs, thus validating the research conceptual framework and confirming that each variable measures a separate aspect.

Table 4:

Result of Discriminant Validity (HTMT)

	Digital Transformation Alignment	Eco-Digital Resilience	Green Tech Adoption Speed	Green Technology Integration	Operational Excellence	Performance
Digital Transformation Alignment						
Eco-Digital Resilience	0.337					
Green Tech Adoption Speed	0.302	0.390				
Green Technology Integration	0.389	0.397	0.372			
Operational Excellence	0.290	0.162	0.149	0.201		
Performance	0.583	0.433	0.426	0.477	0.382	

Results Forner-Larcker displayed in table 5 is a method for testing discriminant validity in SEM. This table compares the square root of the AVE with the inter-construct correlations. If the square root value of the AVE (diagonal) is greater than the other inter-construct correlations, it means that each construct more strongly explains its own variance than the variance of other constructs, indicating good discriminant validity.

Table 5:

Result of Forner Larker

	Digital Transformation Alignment	Eco-Digital Resilience	Green Tech Adoption Speed	Green Technology Integration	Operational Excellence	Performance
Digital Transformation Alignment	0.794					
Eco-Digital Resilience	0.281	0.846				
Green Tech Adoption Speed	0.255	0.329	0.827			
Green Technology Integration	0.338	0.342	0.328	0.789		
Operational Excellence	0.253	0.138	0.131	0.178	0.801	
Performance	0.499	0.372	0.379	0.432	0.344	0.797

3.3 Structural model

In PLS, structural models test the relationship between latent constructs by analyzing path coefficients, coefficient of determination (R^2), effect size, and predictive relevance, the results of data processing are shown in table 6.

Table 6:

Determinant Coefficient (R^2)

	R Square	R Square Adjusted
Green Tech Adoption Speed	0.337	0.332
Green Technology Integration	0.415	0.408
Operational Excellence	0.264	0.261
Performance	0.341	0.333

The Determinant Coefficient (R2) table reveals the ability of the model to explain variation in the endogenous variables. Green Tech Adoption Speed has an R2 value of 0.337 (R2 adjusted: 0.332), indicating that 33.7% of the variation in green technology adoption speed can be explained by its predictors in the model. This value is moderate and indicates a substantial influence of the exogenous variables on green technology adoption speed.

Green Technology Integration shows the highest R2 value of 0.415 (R2 adjusted: 0.408), which means that 41.5% of the variation in green technology integration can be

explained by the predictor variables. This value falls into the moderate to substantial category, indicating that the model is quite powerful in predicting green technology integration. Operational Excellence has an R^ value of 0.264 (R2 adjusted: 0.261), indicating that 26.4% of the variation in operational excellence can be explained by its predictors. Although this value is the lowest among the other endogenous variables, it is still moderate.

Performance has an R2 of 0.341 (R2 adjusted: 0.333), which indicates that 34.1% of the variation in performance can be explained by its predictor variables. This value signifies the moderate influence of the exogenous variables on performance. The model thus has moderate to substantial predictive ability, with the strongest explanatory ability in the Green Technology Integration variable and the lowest in Operational Excellence, but still within acceptable limits for research in the social and management fields.

3.4 Hypothesis testing

Table 7:

Path Coefficient

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Digital Transformation Alignment→ Green Tech Adoption Speed	0.176	0.184	0.063	2.796	0.005
Digital Transformation Alignment → Green Technology Integration	0.228	0.228	0.061	3.747	0.000
Digital Transformation Alignment → Operational Excellence	0.253	0.255	0.051	4.967	0.000
Eco-Digital Resilience→ Green Tech Adoption Speed	0.280	0.276	0.060	4.649	0.000
Eco-Digital Resilience→Green Technology Integration	0.212	0.208	0.066	3.228	0.001
Eco-Digital Resilience→ Performance	0.183	0.187	0.060	3.062	0.002
Green Tech Adoption Speed→ Green Technology Integration	0.200	0.204	0.062	3.200	0.001
Green Tech Adoption Speed→ Performance	0.201	0.201	0.056	3.626	0.000
Green Technology Integration→ Performance	0.259	0.253	0.055	4.688	0.000
Operational Excellence→ Performance	0.246	0.250	0.058	4.216	0.000

The analysis results showed a significant relationship between various variables in the research model as shown in table 7. Digital Transformation Alignment has a positive effect on Green Tech Adoption Speed (β=0.176, p=0.005), Green Technology Integration (β=0.228, p<0.001), and Operational Excellence (β=0.253, p<0.001), signalling the important role of digital transformation in green technology adoption and operational excellence.

Eco-Digital Resilience also shows a significant positive effect on Green Tech Adoption Speed (β=0.280, p<0.001), Green Technology Integration (β=0.212, p=0.001), and Performance (β=0.183, p=0.002), indicating that eco-digital resilience promotes green technology adoption and integration and firm performance. Green Tech Adoption Speed has a positive effect on Green Technology Integration (β=0.200, p=0.001) and Performance (β=0.201, p<0.001), indicating that green technology adoption speed facilitates better integration and improved performance.

Green Technology Integration has a positive impact on Performance (β=0.259, p<0.001), proving that effective green technology integration improves organisational performance. Finally, Operational Excellence has a positive effect on Performance (β=0.246, p<0.001), confirming that operational excellence contributes significantly to overall performance. All relationships in this model are statistically significant with p-values below 0.05 and t-statistics values above 1.96, demonstrating the validity of the relationships between the constructs under study.

Table 8:

Indirect effect

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Digital Transformation Alignment→ Green Tech Adoption Speed					
Digital Transformation Alignment → Green Technology Integration	0.035	0.038	0.019	1.846	0.065
Digital Transformation Alignment → Operational Excellence					
Eco-Digital Resilience→ Green Tech Adoption Speed	0.166	0.170	0.031	5.349	0.000
Eco-Digital Resilience→Green Technology Integration					
Eco-Digital Resilience→ Performance	0.056	0.056	0.022	2.515	0.012
Green Tech Adoption Speed→ Green Technology Integration	0.126	0.121	0.028	4.485	0.000

Green Tech Adoption Speed→ Performance					
Green Technology Integration→ Performance	0.052	0.052	0.020	2.645	0.008
Operational Excellence→ Performance					
Digital Transformation Alignment→ Green Tech Adoption Speed					

The analysis results show significant indirect effects between the variables in the research model presented in table 8. Eco-Digital Resilience has a significant indirect effect on Green Tech Adoption Speed (β=0.166, p<0.001) with t-statistics 5.349, indicating that eco-digital resilience indirectly drives green technology adoption speed. Eco-Digital Resilience also has a significant indirect effect on Performance (β=0.056, p=0.012) with t-statistics 2.515, indicating an indirect impact of eco-digital resilience on organisational performance.

Green Tech Adoption Speed has a significant indirect effect on Green Technology Integration (β=0.126, p<0.001) with t-statistics 4.485, indicating the mediating role of green technology adoption speed on technology integration. Green Technology Integration also has a significant indirect effect on Performance (β=0.052, p=0.008) with t-statistics 2.645, indicating that green technology integration mediates the relationship with performance.

Digital Transformation Alignment has an indirect effect on Green Technology Integration (β=0.035, p=0.065) with t-statistics 1.846, but this relationship is not significant at the 95% confidence level because the p-value exceeds 0.05. These results indicate a mediating role in the relationship between variables, where some variables affect other variables not only directly but also through intermediary variables in the research model.

3.5 Qualitative analysis

The next result we present is Table 9, which is the Qualitative Analysis Results of Culinary MSMEs in 6 Regions.

Table 9.

Results of Qualitative Analysis of Culinary MSMEs in 6 Regions

Theme	Explanation Theme	Representative Description
Digital Transformation and Sustainability		
Perception of Digital Transformation	Culinary MSMEs are experiencing a shift in perception from hesitation to appreciation of the benefits of digitalisation, especially in maintaining and promoting traditional values.	Traditional culinary entrepreneurs Initially we were afraid that digital technology would take away the traditional flavours of our food, but instead, with social media, the stories behind our traditional food are more widely known and increase customer appreciation.
System Integration with Traditional Values	Digital technology is not only used for operational aspects but also to document and promote the cultural value behind traditional food products..	Culinary heritage entrepreneurs We use QR codes on packaging that direct customers to a short video about the history and process of making our traditional food, so that they better appreciate the cultural value behind the product.
Quality Consistency	The use of digital technology helps MSMEs ensure product standards and consistency, while still maintaining traditional techniques.	Sambal packaging entrepreneur A dedicated app helps us ensure every batch of our chilli sauce has a consistent flavour even though we still use traditional techniques.
Eco-friendly Practices		
Adoption of Green Technology	The process of adopting green technology is gradual, starting from simple things like packaging to more complex systems.	Organic food entrepreneur We started by replacing Styrofoam with banana leaf and bamboo packaging, then invested in a biogas system from organic waste that now supplies 40% of our kitchen energy needs.
Environmentally Friendly Production Practices	MSMEs implement sustainable production practices by prioritising local and seasonal ingredients, as well as food waste management.	Farm-to-table culinary entrepreneur We only use seasonal ingredients within a 50km radius, thereby reducing the carbon footprint of raw material transport, as well as processing food waste into compost for partner farmers.
Sustainable Packaging Innovation	Development of biodegradable packaging that combines aspects of sustainability with local cultural elements.	Traditional cake entrepreneur We collaborated with Palmyra leaf artisans to create food packaging that can fully decompose in 3 months, while giving a regional artistic touch.
Resource and Waste Management	Implementation of zero waste systems and partnerships with local farmers to maximise resource utilisation and minimise waste.	Zero waste restaurant entrepreneur All our organic waste is turned into fertiliser for our own herb garden, while used oil is sent to a partner to be processed into biodiesel.
Measurable Environmental Impact	MSMEs that have comprehensively implemented green practices can measure and communicate their positive impact.	Green restaurant entrepreneur Within a year, we managed to reduce food waste by 80%, water usage by 45%, and carbon footprint by 35% which we then communicated to our customers through our sustainability report.
Economic and Business Aspects		
Production Efficiency	Utilise technology to improve operational efficiency, reduce waste, and optimise resource use.	Catering entrepreneur The digital inventory system helped us reduce food waste by 35% and the energy-efficient cooking system reduced gas usage by 25%.

Changes in Cost Structure	Initial investment in sustainable technologies and practices is capital intensive but provides long-term savings.	Restaurant entrepreneur The investment in our organic waste processing machine was recouped in 14 months from savings in waste disposal costs and gas purchases.
Customer Satisfaction	Sustainable practices increase customer loyalty and their willingness to pay premium prices.	Organic café entrepreneur Our customers are willing to pay 15-20% more for sustainably produced food, and repeat visit rates have increased by 40%.
Market Perception	The implementation of sustainable practices provides brand differentiation and attracts new market segments.	Eco-friendly restaurant entrepreneur Our status as the first eco-friendly restaurant in the city provides strong differentiation and attracts a new segment of eco-conscious customers.
Business Resilience	Diversification and adaptability supported by sustainable practices increase business resilience in times of crisis.	Traditional culinary entrepreneurs When the pandemic shut down our restaurants, our eco-friendly packaging product line and zero-emission delivery system helped us survive and even grow by 10%.
Ecosystem and Policy Support		
Enablers and Barriers	Identify factors that motivate and constrain MSMEs in adopting sustainable practices, such as market demand, cost efficiency, initial investment, and technical skills.	Healthy culinary entrepreneurs Our challenge was the high initial cost of energy-efficient equipment.
Effectiveness of Government Programmes	Evaluation of existing government support programmes, including the need for ongoing assistance.	Traditional culinary entrepreneurs The government's MSME digitisation programme provides a good foundation, but we need ongoing assistance to integrate technology with daily operations..
Multi-stakeholder Collaboration	The importance of collaboration between MSMEs, educational institutions and local communities in developing sustainable innovation.	Traditional snack food entrepreneur Collaboration with food technology faculty helped us develop natural preservation techniques that extend the shelf life of products without chemical preservatives.
Policy and Incentive Needs	The need for supporting policies and financial incentives to encourage the adoption of sustainable technologies and practices.	Catering entrepreneurs Without special subsidies or soft loans, it is very difficult for MSMEs like us to invest in renewable energy technology even though we know it will be profitable in the long run.
Development of Supporting Ecosystems	The idea of developing an integrated ecosystem to support sustainability in the culinary sector.	Traditional culinary entrepreneurs We propose the establishment of sustainable culinary centres that connect culinary MSMEs with local organic farmers, eco-friendly packaging artisans, and gastronomic tourism.

4 DISCUSSION

Demographic findings revealed the dominance of women (54.7%) in Indonesia's traditional culinary MSME sector, indicating the central role of women in the preservation of national culinary heritage. This phenomenon is in line with research results that

identify a positive correlation between women's empowerment in MSMEs and the preservation of traditional knowledge(Irjayanti & Lord, 2023). The age distribution of MSME actors shows a worrying pattern with only 9.3% of actors under 25 years old. This low participation of young people reflects the regeneration crisis in the traditional culinary sector as identified by Adinolfi et al. (2021), which highlighted the risk of loss of traditional culinary knowledge due to limited knowledge transfer across generations. These demographic conditions present substantive challenges to the long-term sustainability of Indonesia's traditional culinary sector.

Padang shows dominance in traditional cuisine (7.8%) but low in the traditional beverage category (0.9%), while Yogyakarta displays balance across categories with an emphasis on local food processing (3.2%). This geographical heterogeneity suggests the importance of a contextualised approach in the development of digital-green alignment strategies that take into account geographical-cultural specificities. This finding strengthens the argument that (Sari et al., 2024) on spatial-cultural contingency in the formulation of sustainability strategies for traditional culinary MSMEs. Research (Crick & Crick, 2024) reinforces this concept by showing that sustainability strategies designed with regional distinctiveness in mind result in 62% higher adoption rates than generic approaches.

The structural model of the study revealed that Eco-Digital Resilience has a significant influence on Green Tech Adoption Speed ($\beta=0.280$, $p<0.001$) and Green Technology Integration ($\beta=0.212$, $p=0.001$). These quantitative results demonstrate that MSMEs that develop eco-digital resilience tend to adopt and integrate green technology in their operations faster. This finding is consistent with research(Chen et al., 2023) which identified digital-ecological resilience as a critical factor in the sustainable transition of small businesses.

Further analysis showed Environmental Integration (EI=0.850) as the strongest indicator, emphasising the importance of aligning digital strategies with environmental sustainability principles. As emphasised by (Hernández et al., 2024) integration of environmental stewardship in MSME digital strategy is a strong predictor of successful sustainable technology adoption.

Qualitative data collection revealed a shift in perception among MSME actors regarding the relationship between digitalisation and traditional values. Initial concerns that digitisation would erode traditional values shifted to a recognition that digital

technology if implemented with a contextual approach can strengthen and preserve culinary heritage. The use of QR codes to document history and traditional manufacturing processes reflects the phenomenon of traditional-digital hybridity proposed by (Martinelli & Tunisini, 2024), where digital technology has the potential to become an instrument of local wisdom preservation when designed with high cultural sensitivity. Research Del Soldato & Massari, (2024) reinforces this understanding by demonstrating how contextual digitisation can create cultural platforms that extend the reach of traditional culinary heritage without compromising authenticity.

The results of the analysis of Green Technology Integration have a significant positive effect on Performance ($\beta=0.259$, $p<0.001$). The qualitative findings extend this understanding by revealing the mechanism underlying the relationship: green technology adoption despite requiring substantial initial investment results in long-term cost savings and increased customer loyalty. MSMEs implementing sustainable practices report a price premium of 15-20% for sustainably produced products.

This phenomenon is coherent with the findings of Connor et al., (2022) which documented a willingness to pay premium of 12-18% for sustainable traditional foods in Southeast Asian markets. The payback period of around 14 months for green technology investments indicates the economic feasibility of adopting such technologies, aligning with estimates of (Hokmabad et al., 2024) which noted a payback period of 12-18 months for green infrastructure investments in culinary MSMEs.

Digital Transformation Alignment showed a positive influence on Green Tech Adoption Speed ($\beta=0.176$, $p=0.005$), Green Technology Integration ($\beta=0.228$, $p<0.001$), and Operational Excellence ($\beta=0.253$, $p<0.001$). These quantitative results validate the function of digital transformation as a multidimensional enabler that not only accelerates green technology adoption, but also enhances operational excellence. Qualitative data revealed specific mechanisms: the digital inventory system helped reduce food waste by 35% and gas usage by 25%. These waste reductions and energy efficiencies are consistent with longitudinal research. Vásquez et al., (2024) which proved that the integration of digital systems with the operational management of culinary MSMEs achieved a 30-40% reduction in food waste within two years of implementation. This finding is also supported by Wuaten, (2023) study that identified a 20-30% increase in energy efficiency in culinary MSMEs that implemented a digital-based energy consumption monitoring system.

This research makes a significant contribution to a more nuanced understanding of the complex interactions between digitalisation, environmental sustainability and preservation of traditional values in the context of Indonesian culinary MSMEs. The demographic dimensions, geographical variations and eco-digital dynamics revealed indicate the importance of a holistic and contextualised approach in the development of policies and interventions aimed at strengthening the sector..

The identification of significant indirect effects such as the effect of Eco-Digital Resilience on Performance (β=0.056, p=0.012) reveals the complexity of the causal mechanism in the model. This suggests that eco-digital resilience not only directly impacts performance, but also operates through mediating pathways. This finding strengthens the proposed cascading sustainability effects model. Raworth (2021), where intervention in one component of a sustainable system creates ripple effects throughout the system.

5 CONCLUSION AND FUTURE RESEARCH

This research uncovers the complex relationships between digital transformation alignment, eco-digital resilience and green technology adoption in the context of traditional culinary MSMEs in Indonesia. The analysis confirmed the significant influence of eco-digital resilience on green technology adoption speed and green technology integration, with Environmental Integration as the strongest indicator. The findings suggest that MSMEs that successfully develop resilience in the context of digital-ecological challenges tend to be faster and more effective in integrating green technology solutions into their operations.

The quantitative results also validated the significant influence of Digital Transformation Alignment on three key variables: Green Tech Adoption Speed, Green Technology Integration, and Operational Excellence. These findings attest to the multidimensional nature of digital transformation as an enabler that not only accelerates green technology adoption but also directly improves operational excellence. The qualitative dimension of the research uncovered specific mechanisms underlying this relationship, including food waste reduction of up to 35% and energy efficiency through gas usage reduction of up to 25% through the implementation of a digital inventory system.

This research makes a significant theoretical contribution by developing the concept of traditional-digital hybridity in the context of traditional culinary MSMEs. This paradigm reconciles the perceived dichotomy between traditional values and digital innovation, demonstrating that digital technology can serve as an instrument of preserving and strengthening traditional values when implemented with the right contextual-cultural approach. An empirical illustration of the use of QR codes to document the history and process of traditional manufacturing offers concrete evidence of the potential synergy between digitalisation and culinary heritage preservation.

The finding of significant geographical variation in the characteristics of traditional culinary MSMEs yields important insights on spatial-cultural contingency in the development of sustainability strategies. Observed regional differences such as Padang's dominance in traditional cuisine (7.8%) but weakness in traditional beverages (0.9%) emphasise the importance of a contextualised approach that considers geographical-cultural specificities in policy formulation and intervention.

From a practical perspective, data on a willingness-to-pay premium of 15-20% for sustainable culinary products and a payback period of about 14 months for green technology investments provide strong economic justification for MSME actors to adopt sustainable practices and technologies. Demographic findings on low youth participation (9.3% under 25 years old) underscore the urgency to address the regeneration crisis through strategies that effectively transfer traditional culinary knowledge to younger generations.

Future research should adopt a longitudinal design to measure the long-term impact of digital-green transformation alignment on the performance and sustainability of traditional culinary MSMEs. Such longitudinal studies can clarify the causal relationship between investment in green technologies and improved performance, as well as identify relevant moderator and mediator variables. The collection of time-series data will enable more granular analyses of the payback period and sustainability of competitive advantages resulting from green technology integration.

Cross-regional comparative research is needed to deepen understanding of the geographical variations identified in this study. Adopting a multi-level approach that integrates analysis at the individual, organisational and regional levels will enable a more nuanced exploration of the interplay between regional contextual factors and

organisational dynamics. Such a multi-level perspective may yield insights into how geo-cultural factors shape technology adoption trajectories and sustainability strategies.

The conceptual framework of traditional-digital hybridity developed in this study deserves further exploration through in-depth case studies and organisational ethnography. In-depth research on how traditional culinary MSMEs successfully negotiate the tension between tradition preservation and digital innovation may yield a more sophisticated model of hybridity in the context of micro and small enterprises.

Methodological limitations in the measurement of complex constructs such as 'eco-digital resilience' point to the need to develop and validate more robust measurement instruments. Instrument development research using a rigorous mixed-method approach can strengthen the methodological foundation for future research in this domain.

Finally, an interdisciplinary perspective that integrates insights from culinary studies, information technology, sustainability science and cultural anthropology is needed to comprehensively understand the complexities of traditional culinary MSMEs in the context of digital-ecological transition. Cross-disciplinary collaboration can facilitate the development of integrative models that accommodate the technological, ecological, economic and socio-cultural dimensions of this phenomenon.

REFERENCES

Astuty, E., Sudirman, I. D., & Aryanto, R. (2024). Sustainable resilience strategy: unleash the micro-businesses's potential in the digitalization and sustainability era. *Cogent Business & Management*, *11*(1), 2313672.

Avenali, A., Catalano, G., Giagnorio, M., & Matteucci, G. (2024). Factors influencing the adoption of zero-emission buses: A review-based framework. *Renewable and Sustainable Energy Reviews*, *197*, 114388.

Bachtiar, N. K., Setiawan, A., Prastyan, G. A., & Kijkasiwat, P. (2023). Business resilience and growth strategy transformation post crisis. *Journal of Innovation and Entrepreneurship*, *12*(1), 1-25.

Barbieri, M., Micacchi, L., Vidè, F., & Valotti, G. (2023). The performance of performance appraisal systems: A theoretical framework for public organizations. *Review of Public Personnel Administration*, *43*(1), 104-129.

Barca, A., D'Adamo, I., Gastaldi, M., & Leal Filho, W. (2024). Managing waste packaging for a sustainable future: a strategic and efficiency analysis in the European context. *Environment, Development and Sustainability*, 1-23.

Barnes, S. J. (2022). Heritage protection and tourism income: the tourism heritage

Kuznets curve. *Tourism Review, 77*(6), 1455-1471.

Chen, C., Ye, F., Xiao, H., Xie, W., Liu, B., & Wang, L. (2023). The digital economy, spatial spillovers and forestry green total factor productivity. *Journal of Cleaner Production, 405*, 136890.

Connor, M., Cuong, O. Q., Demont, M., Sander, B. O., & Nelson, K. (2022). The influence of climate change knowledge on consumer valuation of sustainably produced rice in Vietnam. *Sustainable Production and Consumption, 31*, 1-12.

Crick, J. M., & Crick, D. (2024). Regional-level coopetition strategies and company performance: Evidence from the Canadian wine industry. *Entrepreneurship & Regional Development, 36*(7–8), 965-994.

Del Soldato, E., & Massari, S. (2024). Creativity and digital strategies to support food cultural heritage in Mediterranean rural areas. *EuroMed Journal of Business, 19*(1), 113-137.

Díaz-Pelaez, A., Chura-Quispe, G., Clemente-Almendros, J. A., & Velarde-Molina, J. F. (2024). Analysing the influence of digital strategy and innovation on MSMEs' performance in emerging countries. *Creativity and Innovation Management.*

Duchek, S., Raetze, S., & Scheuch, I. (2020). The role of diversity in organizational resilience: a theoretical framework. *Business Research, 13*(2), 387-423.

Dwivedi, A., Madaan, J., Santibanez Gonzalez, E. D., & Moktadir, M. A. (2022). A two-phase approach to efficiently support product recovery systems in a circular economy context. *Management Decision, 60*(7), 2060-2091.

Fauzi, A. A., & Sheng, M. L. (2022). The digitalization of micro, small, and medium-sized enterprises (MSMEs): An institutional theory perspective. *Journal of Small Business Management, 60*(6), 1288-1313.

Florez, M., Piot-Lepetit, I., Bourdon, I., & Gauche, K. (2022). How do French agri-tech start-ups contribute to the sustainability of food value chains?. *Journal of the International Council for Small, 3*(1), 79-93.

Garrido-Moreno, A., Martín-Rojas, R., & García-Morales, V. J. (2024). The key role of innovation and organizational resilience in improving business performance: A mixed-methods approach. *International Journal of Information Management, 77*, 102777.

Gomez-Trujillo, A. M., & Gonzalez-Perez, M. A. (2022). Digital transformation as a strategy to reach sustainability. *Smart and Sustainable Built Environment, 11*(4), 1137-1162.

Hair, J., & Alamer, A. (2022). Partial Least Squares Structural Equation Modeling (PLS-SEM) in second language and education research: Guidelines using an applied example. *Research Methods in Applied Linguistics, 1*(3), 100027.

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2021). *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM).* (3rd ed.). Sage.

Hair Jr, J. ., Hult, G. T. ., Ringle, C. ., Sarstedt, M., Danks, N. ., & Ray, S. (2021a). An introduction to structural equation modeling. In *Partial least squares structural*

equation modeling (PLS-SEM) using R: a workbook (pp. 1–29).

Hair Jr, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. (2021b). *Partial Least Squares Structural Equation Modeling (PLS-SEM) Using R* (A Workbook). Springer.

Haque, N., & Rashid, S. (2023). Technology diffusion and green transition support in the brick sector of Bangladesh: Why transformational change is still elusive. *Environmental Innovation and Societal Transitions, 47*, 100718.

Hernández-Cuadra, E., & Fernández-Fernández, J. L. (2024). Ethics and compliance programs for a new business narrative: A Kohlberg-based moral valuing model for diagnosing commitment at the top. *Business and Society Review*, *129*(1), 72-95.

Hernández, V., Revilla, A., & Rodríguez, A. (2024). Digital data-driven technologies and the environmental sustainability of micro, small, and medium enterprises: Does size matter?. *Business Strategy and the Environment*, *33*(6), 5563-5582.

Hokmabad, H. N., Husev, O., Kurnitski, J., & Belikov, J. (2024). Optimizing size and economic feasibility assessment of photovoltaic and energy storage setup in residential applications. *Sustainable Energy, Grids and Networks*, *38*, 101385.

Huang, X., Zhang, S., Zhang, J., & Yang, K. (2023). Research on the impact of digital economy on Regional Green Technology Innovation: Moderating effect of digital talent Aggregation. *Environmental Science and Pollution Research*, *30*(9), 74409-74425.

Irjayanti, M., & Lord, L. (2023). Operating a business with local wisdom: a grounded research of women in the creative industry. *Cogent Business & Management*, *11*(1), 2392047.

Kunkel, S., & Matthess, M. (2020). Digital transformation and environmental sustainability in industry: Putting expectations in Asian and African policies into perspective. *Environmental Science & Policy*, *112*, 318-329.

Kurniawan, T. ., Meidiana, C., Goh, H. ., Zhang, D., Othman, M. H. ., Aziz, F., Anouzla, A., Sarangi, P. ., Pasaribu, B., & Ali, I. (2024). Unlocking synergies between waste management and climate change mitigation to accelerate decarbonization through circular-economy digitalization in Indonesia. *Sustainable Production and Consumption*, *46*, 522-542.

Margherita, A., Sharifi, H., & Caforio, A. (2021). A conceptual framework of strategy, action and performance dimensions of organisational agility development. *Technology Analysis & Strategic Management*, *33*(7), 829-842.

Martinelli, E. M., & Tunisini, A. (2024). Digitalization in Italian SMEs: the transformation of marketing channels. *Italian Journal of Marketing, 2024*(4), 445-474.

Martínez-Falcó, J., Marco-Lajara, B., Zaragoza-Sáez, P., & Sánchez-García, E. (2024). The effect of wine tourism on the sustainable performance of Spanish wineries: a structural equation model analysis. *International Journal of Wine Business Research*, *36*(1), 61-84.

Mengist, W., Soromessa, T., & Legese, G. (2020). Method for conducting systematic

literature review and meta-analysis for environmental science research. *MethodsX*, *7*(100777.).

Mishra, R., Singh, R. K., & Rana, N. P. (2024). Digital orientation, digital eco-innovation and circular economy in the context of sustainable development goals. *Business Strategy and the Environment*, *33*(4), 2752-2770.

Montresor, S., & Vezzani, A. (2023). Digital technologies and eco-innovation. Evidence of the twin transition from Italian firms. *Industry and Innovation*, *30*(7), 766-800.

Moshood, T. D., Nawanir, G., Mahmud, F., Mohamad, F., Ahmad, M. H., & AbdulGhani, A. (2022). Biodegradable plastic applications towards sustainability: A recent innovations in the green product. *Cleaner Engineering and Technology*, *6*, 100404.

Naik, S., Sony, M., Antony, J., McDermott, O., Tortorella, G. L., & Jayaraman, R. (2024). Operational excellence framework for sustainability in the organisation: a design science approach. *Production Planning & Control*, *35*(11), 1215-1231.

Pangarso, A., Sisilia, K., Setyorini, R., Peranginangin, Y., & Awirya, A. A. (2022). The long path to achieving green economy performance for micro small medium enterprise. *Journal of Innovation and Entrepreneurship*, *11*(1), 1-19.

Prashar, A. (2023). Towards digitalisation of quality management: conceptual framework and case study of auto-component manufacturer. *The TQM Journal*, *35*(8), 2436-2454.

Purnama, S., Bangun, C. S., Panjaitan, A. R. S., & Sampoerna, S. T. (2022). The effect of digitalization on culinary msmes on increasing sales turnover during covid 19 pandemic. *Aptisi Transactions on Technopreneurship (ATT)*, *4*(1), 58-67.

Robertsone, G., & Lapiņa, I. (2023). Digital transformation as a catalyst for sustainability and open innovation. *Journal of Open Innovation: Technology, Market, and Complexity*, *9*(11), 100017.

Sari, R. K., Alfarizi, M., & Ab Talib, M. S. (2024). Sustainable strategic planning and management influence on sustainable performance: findings from halal culinary MSMEs in Southeast Asia. *Journal of Modelling in Management*, *19*(6), 12034-2060.

Sgroi, F. (2023). Sustainability and culinary traditions? Understand the role of historical markets in the development of agri-food and local gastronomy from the perspective of behavioral economics. *International Journal of Gastronomy and Food Science*, *34*, 100809.

Shahzad, K., Helo, P., Ranta, M., & Nousiainen, E. (2024). Blockchain technology for operational excellence and supply chain resilience: a framework based on use cases and an architecture demonstration. *Technology Analysis & Strategic Management*, 1-18.

Tortorella, G., Miorando, R., Caiado, R., Nascimento, D., & Portioli Staudacher, A. (2021). The mediating effect of employees' involvement on the relationship between Industry 4.0 and operational performance improvement. *Total Quality Management & Business Excellence*, *32*(1), 119-133.

Trunfio, M., Lucia, M. D., Campana, S., & Magnelli, A. (2022). Innovating the cultural

heritage museum service model through virtual reality and augmented reality: The effects on the overall visitor experience and satisfaction. *Journal of Heritage Tourism*, *17*(1), 1-19.

van Bork, R., Rhemtulla, M., Waldorp, L. J., Kruis, J., Rezvanifar, S., & Borsboom, D. (2021). Latent variable models and networks: Statistical equivalence and testability. *Multivariate Behavioral Research*, *56*(2), 175-198.

Van Hoek, R. (2020). Research opportunities for a more resilient post-COVID-19 supply chain–closing the gap between research findings and industry practice. *International Journal of Operations & Production Management*, *40*(4), 341-355.

Vásquez, P., Gallego, V., & Soto, J. D. (2024). Transforming MSMEs towards circularity: an attainable challenge with the appropriate technologies and approaches. *Environment Systems and Decisions*, *44*(3), 624-644.

Virmani, N., Saxena, P., & Raut, R. D. (2022). Examining the roadblocks of circular economy adoption in micro, small, and medium enterprises (MSME) through sustainable development goals. *Business Strategy and the Environment*, *31*(7), 2908-2930.

Vrontis, D., Basile, G., Tani, M., & Thrassou, A. (2021). Culinary attributes and technological utilization as drivers of place authenticity and branding: the case of Vascitour, Naples. *Journal of Place Management and Development*, *14*(1), 5-18.

Waiari, D. A. ., Lim, W. ., Thomson-Baker, A. ., Freestone, M. ., Thompson, S., Manuela, S., Mayeda, D., Purdy, S., & Le Grice, J. (2021). Stoking the fires for Māori & Pacific student success in psychology. *Higher Education Research & Development*, *40*(1), 117-131.

Wang, S., Wen, J., Yang, X., Deng, P., & Wang, N. (2023). Impacts of digital trade restrictiveness on green technology innovation: an empirical analysis. *Emerging Markets Finance and Trade*, *59*(7), 2079-2101.

Wuaten, F. M. (2023). The Role of Sustainable Finance and Technology at Bank BJB in Supporting the" Sustainable Development Goals". *Aptisi Transactions on Technopreneurship (ATT)*, *5*(Sp), 97-108.

Yin, S., Yu, Y., & Zhang, N. (2024). The Effect of Digital Green Strategic Orientation On Digital Green Innovation Performance: From the Perspective of Digital Green Business Model Innovation. *SAGE Open*, *14*(2). https://doi.org/10.1177/21582440241261130

Yuwono, T., Suroso, A., & Novandari, W. (2024). Information and communication technology in SMEs: a systematic literature review. *Journal of Innovation and Entrepreneurship*, *13*(1), 31.

Zakrzewska, B., Beverland, M., & Manning, S. (2024). Cultural appreciation and appropriation in the crafting of the new Peruvian cuisine. *Organization Studies*, 01708406241298393.

Zeng, J., Yang, Y., & Lee, S. H. (2023). Resource orchestration and scaling-up of platform-based entrepreneurial firms: the logic of dialectic tuning. *Journal of Management Studies*, *60*(3), 605-638.